NEW MATRICULATION
BOTANY

7

To the teacher

New Matriculation Botany is a series of five books developed for class 6-10 of the Tamil Nadu Matriculation system. It closely follows the new enriched Matriculation syllabus.

One of the main features of the new syllabus is that activity and observation are given a very important place in understanding science. Every effort has been made to unfold the scope and purpose of the syllabus. This series departs from the conventional and emphasises a practical, 'discovery' and 'learning by doing' approach.

The subject matter to be studied has been carefully arranged keeping in mind the age level and psychology of the child. No effort has been spared to support the text with clear, labelled illustrations. The language has been kept simple and direct to enable the students to read the text themselves.

Several activities and projects have been suggested, wherever possible, within the scope of the lesson. Most of these need simple improvising or inexpensive materials.

The exercises for each chapter are exhaustive and include questions based on comprehension and application of basic principles rather than on mere recall.

It has been the concern of the authors that children are encouraged to discover for themselves the pleasure of learning about the fascinating world of 'plants'.

The author

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New Matriculation Botany 7

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NEW MATRICULATION
BOTANY 7

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MATRICULATION SYLLABUS FOR STANDARD VII.-BOTANY

S.NO.	*Concept/Theme*	*Expected learning/Outcome*	*Teaching/Learning Activities*
1.	**Diversity of living organisms**		
1.1.	Life span	Recognises that different organisms live for different lengths of time.	Exhibition of a comparative statement of longevity of a few organisms.
1.2.	Difference between plants and animals	Discriminates between plants and animals on different criteria.	Observation of green colouring matter present in plants. Their fixed nature. Preparation of a chart showing the different kinds of locomotion in animals.
2.	**Organisation of plants**		
2.1.	Transport system	Analyses the internal transport system in plants with reference to anatomical features.	Preparation of a list of structures involved in the internal transport system of plants.
2.2.	Meaning and need for transport systems		
2.3.	Transport system in plants. Vascular bundles, xylem, phloem		Girdling experiment-Ascent of sap in plants.
2.4.	Anatomy of leaf	Analyses the internal structure of the leaf with reference to its anatomy.	Observation of internal structure of the leaf under the microscope.
2.5.	Movement	Recalls that movement is one of the properties of living things.	Observing the various movements in plants.
2.6.	Movement in lower plants (Chlamydomonas)		Observing the movement of chlamydomonas.
2.7.	Movement in higher plants-whole plant (touch-me-not) Tropisms-Phototropisms, geotropism and hydrotropism.	Recognises that the whole plant or parts of the plants are involved in movement to satisfy their needs.	Tropisms-simple experiments may be set up.
2.8.	Co-ordination in plant body by growth regulators (auxins), brief account of flowering, ripening and withering of leaf	Analyses the role of harmones in plants.	Parthenocarpy-demonstration of curling of leaf-tip, stunted growth. Visit to a florist's shop.
3.	**Cellular organisation - growth**		
3.1.	Periodic variation in growth	Recognises that growth is one of the chanracteristic features of living things. Interprets variations in growth between individuals.	Sowing seeds in a pot and observing their day to day growth.
4	**Nutrition and hygiene**		
4.1.	Need of food for plants	Recognises the function of food and its importance to a plant	Growing plants in shade with/without supply of water.
4.2.	Need for carbon dioxide, water and minerals as well as sunlight for teh preparaton of food in plants, with simple examples	Recognises the need for certain factors to prepare food to maintain life.	Observation of growth of plants in two different pots of sand, one with water and other without waterin them and making a record of the observation.
4.3.	Spoilage of food-role of bacteria and fungi in the spoilage of food	Infers that spoilage of old food is caused by microscopic organisms.	Examination of fresh and spoiled (food) bread or home made eatables in the class.
4.4	Cleanliness and hygiene in purchase of food items.	Develops habit to eat clean food and rejects food exposed to flies etc.	Discussion on how diseases may be caused by eating food spoiled by bacteria and fungi in unhygienic and insanitary conditions.

S.NO.	Concept/Theme	Expected learning/Outcome	Teaching/Learning Activities
4.5	Prevention of food spoilage, use of preservatives and closed containers.	Adopts appropriate measures to prevent spoilage of food.	Listing of items of food which are home preserved by heating and cooling.
4.6.	Heating cooling-use of preservatives such as salt, sugar and oil	Adopts ways and methods to preserve food.	Discussion on preparation of vattal, chips, jam and pickling of fruits and preparation of fruit juices.
4.7.	Usage of adulterants by unscrupulous business men	Realises the need to eradicate the social evil of adulteration practised by certain business people.	Discussion on the problems of adulteration of food on human health, collection of paper cuttings of new items on adultration.
4.8.	Survival without food	Realises that plants and animals too save for the rainy day and so should men.	Encouragement of small savings scheme.
4.9.	Special methods of procuring food in plants, pitcher plant, bladderwort.	Sees relationship between autotrophs and insectivorous plants.	Observes the preserved insectivorous pants-trapping pattern described.
5.	**Organisms and environment**		
5.1.	Biosphere and energy flow	Analyses the term biosphere and how energy is obtained from one to another and the significance of photosynthesis.	Prepares a diagrammatic representation of energy flow in the biospher.
5.2.	Man and his environment. Soil, rainfall and temperature with reference to natural resources; their uses.	Realises the contribution of soil, rainfall and temperature to man's natural resources.	Understands soil profile, role of temperature and rainfall in natural resources like ponds, river, etc.
5.3.	Balance in nature is upset by overpopulation, abuse of natural resources.	Analyses the effects of overpopulation in terms of balance.	Writes the effects of overpopulation on students surroundings.
5.4.	Man in the biosphere	Realises that man is the sole manager of his environment	Writes some examples to show that the activities of men disturb the environment.
5.5.	Pond/garden/forest to explain the habitat & ecosystem	Infers that ppulation will include only one kind of organism the inevitability of environment, the specific meaning of habitat & the concept of ecosystem.	Taking the students to a nearby pond/garden/forest to explain the population, environment, habitat and ecosystem.
5.6.	Sharing food and shelter by members of population	Realises that population will include only the same type of members and so have same types of food and shelter; comes to know the significance of population growth and food shortage.	Preparation of a list of populations from visits to a pond/garden/forest noting their specific habitats and food habits.
5.7.	Relationship in a population		
5.8.	Food and shelter		
5.9.	Man's role in the detrioration of environment cutting of trees for example	Realises that man contributes most to the deterioration of environment.	Writing an essay on effects of deforestation and presenting it to the class.
5.10.	Forests and environment	Realises the need of conservation of wildlife	Visit to a forest making, the students to celebrate vanamahotsava by conducting essay and painting competitions.

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1. Diversity of living organisms

diversity of living organisms - life span - annuals - biennials - perennials - differences between plants and animals.

There are thousands of different kinds of living things found all over the earth. The inorganic matter existing everywhere provides the necessary materials for the survival of plants and animals which share a number of similarities among themselves. They have to grow, take in food, respire, reproduce and finally die and decay.

Though there are these common properties among plants and animals, there are many differences among them as well. For example, though plants and animals both grow, they do not grow in the same way.

Simililarly they differ vastly in the methods of reproduction, in their movement, nutrition, etc.

There are a number of diversities among plants themselves, for example, in cell number, growth, adaptations, nutrition, reproduction and life span.

1.1 Life span

On the basis of their life span, plants can be divided into three groups: annuals, biennials and perennials.

ANNUALS

These are plants which live for one year or one season. Within this period they grow, reproduce and die, e.g., paddy, maize.

Fig. 1.1 Maize

BIENNIALS

The plants which live for two years are called biennials. They attain their full vegetative growth in the first year and produce flowers and seeds in the second year after which they die, e.g., carrot, radish.

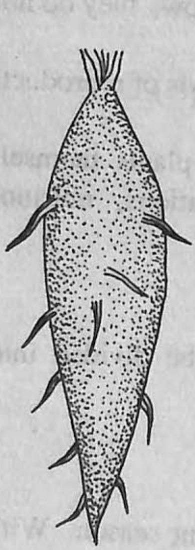

Fig. 1.2 Carrot

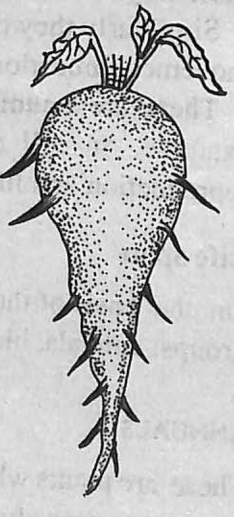

Fig. 1.3 Radish

PERENNIALS

These types of plants live for a number of years. They produce flowers and fruits many times in their life time. Some perennials which have soft stems are called *herbaceous perennials*. Most perennials have woody stems and are called *woody perennials*, e.g., coconut, eucalyptus.

Fig. 1.4 Coconut

Activity 1: *As a class prepare a herbarium of plants and note down their life spans.*

1.2 Differences between plants and animals

We know that plants and animals have many common properties because they are both living things, and also that in certain aspects they differ from each other. These differences are very clear in the higher plants and animals. The main differences between plants and animals are listed below:

1. THE CELL WALL

All living organisms are made up of cells. The plant cell consists of a cell wall which is characteristic only of plant cells. The cell wall is made of a chemical substance called *cellulose*. In the animal cells, the cell wall is absent. Instead, they have *cell membrane* which is made up of protein and lipids.

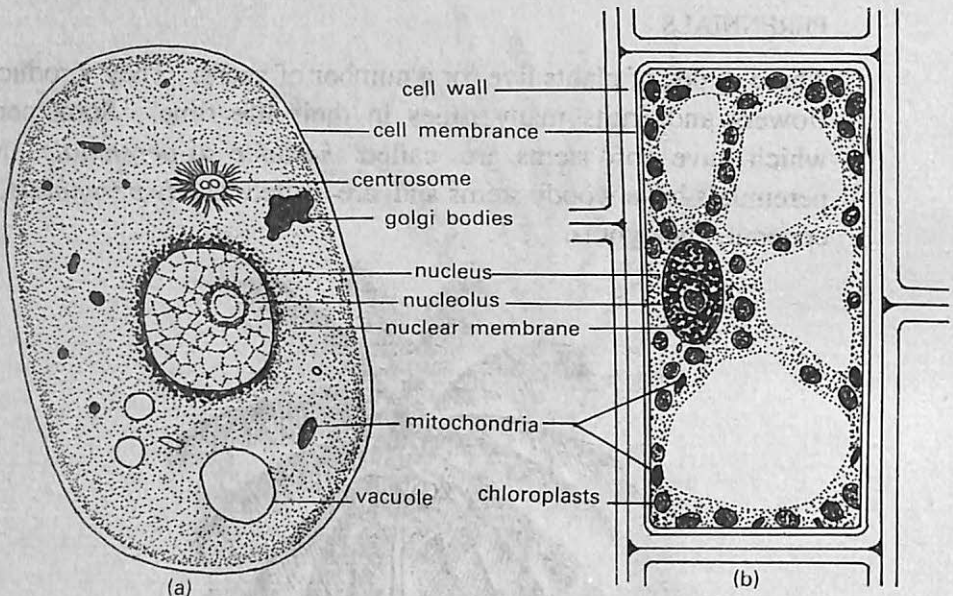

Fig. 1.5 (a) Animal cell (b) Plant cell

2. NUTRITION

Living things need food to grow and for all the metabolic activities. They obtain food substances in different ways. Plants can absorb raw food substances in the form of gases or in a dissolved state. They are said to be *holophytic* in their mode of nutrition. Animals can take

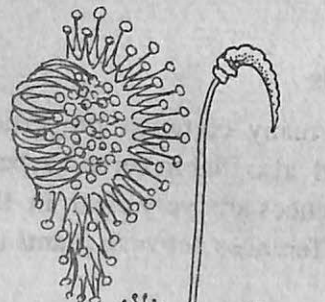

Fig. 1.6 Drosera (Sundew)

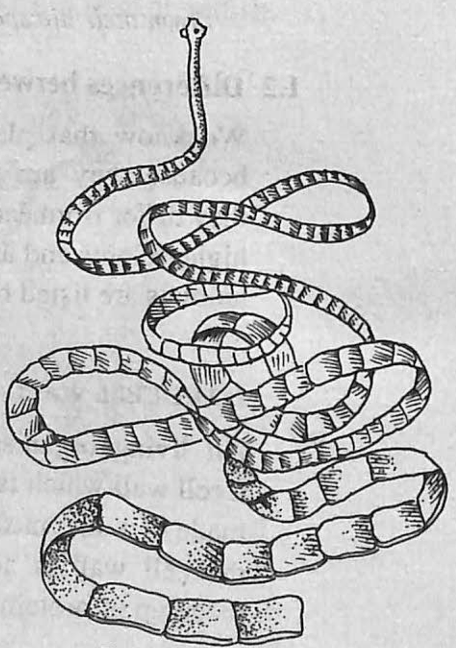

Fig. 1.7 Tapeworm

solid food substances and are said to be *holozoic* in their mode of nutrition. There are, however, some exceptions among plants and animals. Plants like Drosera, Utricularia and Nepenthes trap insects and consume them. Thus they are able to take in solid food substances. In animals, too, parasites like tapeworms are able to take in only liquid form of food.

3. CHLOROPHYLL

The majority of plants are green in colour, because of the presence of a pigment called chlorophyll which helps them in the process of manufacturing their own food. Animals do not have chlorophyll.

4. UTILIZATION OF CARBON DIOXIDE

Plants possess the ability to utilize the carbon dioxide in the atomosphere. This ability is present only in the green cells.

Thus during daytime, the green cells of the leaf absorb carbon dioxide and manufacture sugar. Animals do not possess this ability.

5. GROWTH

The regions of growth are localised in the case of plants, while in the case of animals, growth is not localised to any definite region. In plants, growth continues until death but in animals growth ceases long before death.

6. MOVEMENT

Movement from one place to another is called locomotion. Animals are capable of moving from place to place as they possess separate organs for locomotion, called *locomotor organs*. Excepting a few animals like corals which are attached to the substratum, all the animals are capable of locomotion in search of food and shelter and also to protect themselves from their enemies. Plants, with the exception of a few primitive and lower grade plants like the chlamydomonas, are not capable of locomotion. But the different parts of the plant body exhibit various types of movement called *movement of curvature*. For example, the roots grow towards gravity *(positive geotropism)* and the shoot grows towards sunlight

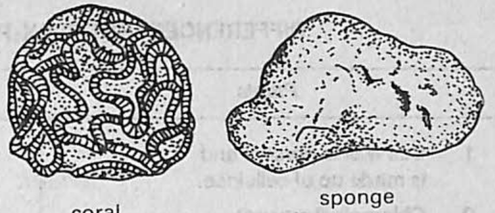

Fig. 1.10 Animals that do not move

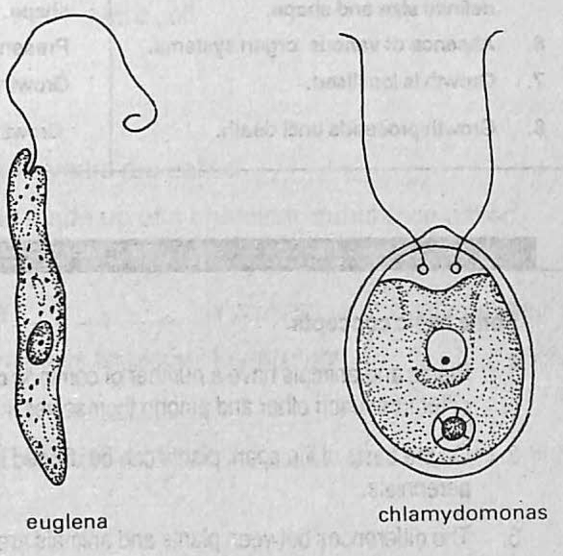

Fig. 1.11 Plants that move freely

7. FORM

Animals usually have a definite size and shape. Plants have a number of branches growing in all directions and this often changes their size and shape.

8. ORGAN SYSTEMS

Animals have various organs like heart, lungs, stomach, intestines, etc. They are organised into systems, each system performing a particular function. But plants have no such organ systems.

Activity 3: *:List out the various organs present in your body. Group them into different organ systems and write their respective functions in a chart.*

phototropism). Again, the root system grows towards the external stimulus of water which is *hydrotropism*.

Activity 2: *Place a potted plant near a window for a few days. Observe what happens. Note down what you observe.*

Fig. 1.8 Movement in all directions in animals.

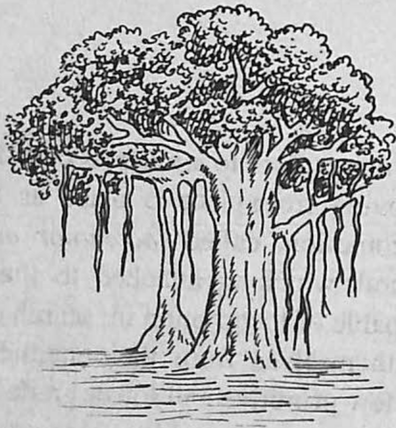

Fig. 1.9 Plants are fixed to the substratum.

DIFFERENCES BETWEEN PLANTS AND ANIMALS

	Plants	*Animals*
1.	Cell wall is present and is made up of cellulose.	Cell membrane is present and is not made up of cellulose.
2.	Chlorophyll present.	Chlorophyll absent.
3.	Usually do not move from place to place.	Usually move from place to place.
4.	Holophytic mode of nutrition.	Holozoic in nutrition.
5.	Branched and so do not have a definite size and shape.	Unbranched and have a definite shape.
6.	Absence of various organ systems.	Presence of various organ systems.
7.	Growth is localised.	Growth is not localised.
8.	Growth proceeds until death.	Growth ceases long before death.

Some basic concepts

1. Plants and animals have a number of common characteristics but they also differ from each other and among themselves in a number of ways.
2. On the basis of life span, plants can be divided into annuals, biennials and perennials.
3. The differences between plants and animals are in a) the cell wall, b) nutrition, c) chlorophyll, d) utilization of carbon dioxide, e) growth, f) movement, g) form, and organ systems.

Some suggested activities / projects

1. Collect and preserve the leaves of plants whose life span is one year.
2. Collect the pictures of perennials and paste them in an album.

REVISION TIME

I. *Match the following:*

1. cell wall	animal
2. nepenthes	plant
3. paddy	insectivorous plant
4. holozoic	annuals
5. holophytic	plant cell

II. *Fill in the blanks.*

1. Plants which grow for two years are called ____________.
2. The cell wall in plants is made up of a chemical substance called ______________.
3. Instead of a cell wall, a ____________ is present in the animal cell.
4. Animals can move from place to place in search of __________ and ______________ and to _____________.
5. Movement towards the external stimulus of _______________ is called by hydrotropism.

III. *Write short notes on:*

1. Biennials and perennials.
2. Chlorophyll.
3. Movement of curvature.

IV. *Answer the following questions:*

1. How can you classify plants on the basis of their life span?
2. List the differences between plants and animals.
3. What is meant by holophytic and holozoic modes of nutrition?

2. Organisation of plants

transport system - meaning and need for transport systems - transport system in plants vascular bundles - xylem - phloem - anatomy of leaf - movement in lower plants - movement in higher plants - phototropism - geotropism - hydrotropism - nastic movement - co-ordination in plant body by growth regulators.

In the higher plants, the body of the plant is clearly differentiated into root, stem and leaves. The primary function of the root is anchoring the plant to the soil. So the roots grow towards gravity. Roots absorb water and minerals from the soil. To perform this function the roots have to grow towards the stimulus of water. The leaves prepare the complex food materials from carbon dioxide and water using the solar energy trapped by the chlorophyll. Since the leaves absorb solar energy, they have to grow towards the stimulus of light. The stems conduct water and dissolved mineral salts from the roots to the leaves. They also conduct prepared food from the leaves to different parts of the plant. Then the stem acts as a conducting channel through which water and food materials are transported. This work is done by a special tissue known as the conducting tissue.

2.1 Transport system

Gases and liquids have to move to the different parts of the plant. The movement of gases is through the intercellular spaces. When the gases move through the intercellular spaces, all the cells get oxygen for respiration. During the process of respiration oxygen is absorbed and carbon dioxide is given out. Carbon dioxide is absorbed and oxygen is released during photosynthesis. Gases enter through the stomatal openings and lenticels. The root hairs absorb water from the soil. The food materials are prepared by the green parts of the plant body. Water and the food materials thus obtained are then transported to the different parts of the plant by a special tissue known as vascular tissue or conducting tissue.

2.2 Meaning and need for transport

All parts of the plant need a continuous supply of food for their various metabolic activities. In simple and primitive types of plants like the spirogyra, all the cells are green and each cell can make enough food for itself. But in higher plants, the green cells are present mostly in the leaves, and food materials are synthesised mainly in the leaves. The non-green parts must get their food supply from the leaves. This movement of food materials from one part of a plant to another is termed *translocation.*

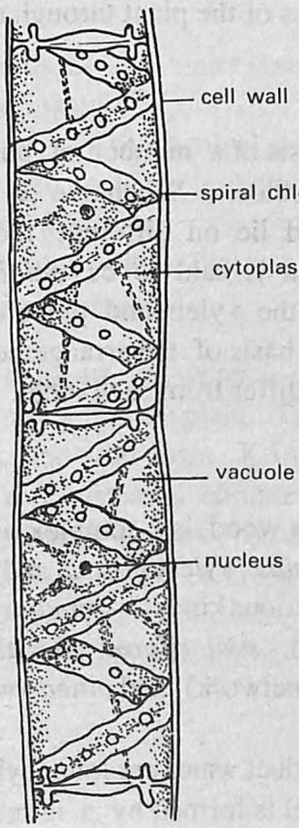

Fig. 2.1 Spirogyra

Large quantities of water are absorbed by the roots. All the water absorbed by the roots is not utilised by the plant. The major portion of it evaporates from various parts of the plant. Before this, the water absorbed must be conducted upwards to the transpiring surfaces. This upward movement of water is called the *ascent of sap*.

2.3 Transport system in plants, vascular bundles, xylem, phloem

While considering the transport of liquids in plants two things must be taken into account. Firstly , it is the upward movement of water and minerals. The water absorbed by the root hairs travels inwards in the cortex, reaches the xylem elements and then it moves upwards. Thus the water and dissolved minerals are transported to the different parts of the plant body through the xylem.

The second thing is the conduction of prepared food to different parts of the plant. Food, prepared mainly in the green parts of the plant body, is used for various metabolic activities. For this purpose it is transported to different parts of the plant through the phloem.

VASCULAR BUNDLES

The vascular tissue consists of a number of bundles. Each bundle is made up of xylem and phloem. When the xylem and phloem form separate bundles and lie on different radii alternating with each other, the arrangement is said to be *radial*. The arrangement is said to be *collateral* when the xylem and phloem lie together on the same radius. Thus, on the basis of the arrangement of xylem and phloem, vascular bundles differ from each other.

XYLEM

Xylem, otherwise known as wood, is a complex tissue. It consists of *trachea* or vessels, *tracheids*, *xylem fibres* and *xylem parenchyma*. The xylem vessels are of various kinds — *annular* (a ring - like structure), *spiral* (in a spiral manner), *scalariform* (in the form of a ladder), *reticulate* (in the form of a network) and *pitted* (with simple or bordered pits).

These vessels which conduct water are long, cylindrical and have slanting ends. Each vessel is formed by a number of cells connected end to end. They are, however, dead cells.

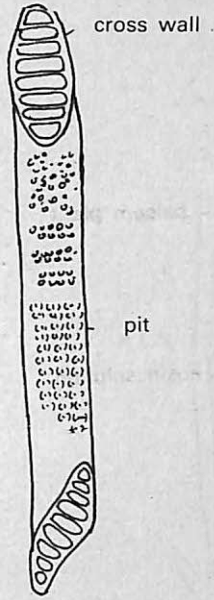

Fig. 2.2 A vessel segment

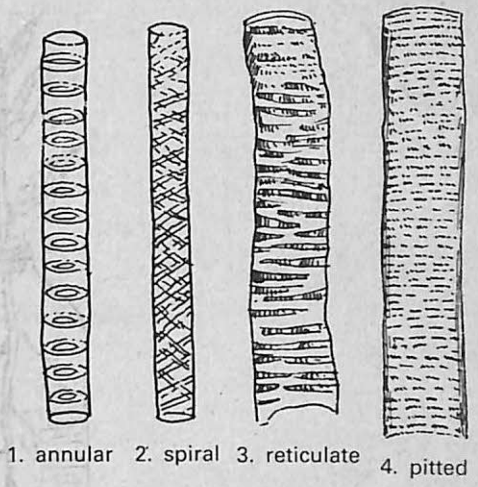

Fig. 2.3 Vessels

The tracheids are also water conducting elements. They are long and have tapering ends.

Xylem fibres give mechanical strength. Xylem parenchyma is a thin-walled living cell. It helps in the conduction process and also in the storage of food and water.

The first formed xylem is known as *proto-xylem*. The xylem formed later is called *meta-xylem*.

Experiment to prove that water is conducted through the xylem: : Uproot carefully a balsam plant. Take a bottle containing water which has been coloured with eosin. Keep the plant in the bottle in such a way that the root system is completely immersed in water.

After sometime, a streak of red colour will be seen along the whole of the stem and veins. When cross and longitudinal sections of the stem at different lengths are examined under a microscope, it will be evident that the coloured solution has travelled upwards only through the xylem.

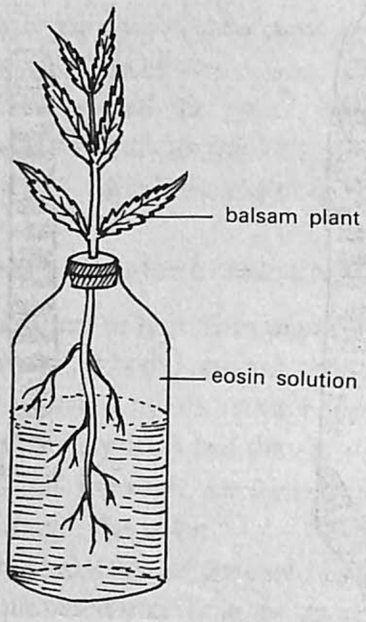

Fig. 2.4 Experiment to demonstrate the path of sap

Activity 1: *Break the continuity of the xylem in a small plant by making two opposite half cuts, a short distance apart, in the main stem. Observe what happens.*

PHLOEM

Phloem is otherwise called *bast*. It conducts the prepared food material downwards to the different parts of the plant where it is utilised. It consists of *sieve tubes*, *companion cells*, *phloem fibres* and *phloem parenchyma*.

Sieve tubes are the main channels through which conduction takes place. Between the sieve tubes, there are perforated sieve plates which filter the food materials. Companion cells and phloem parenchyma assist the sieve tubes in conduction. They also transport many of the soluble food materials sideways to the surrounding tissues. Phloem fibres give mechanical support. All the elements of the phloem are made of cellulose and are living.

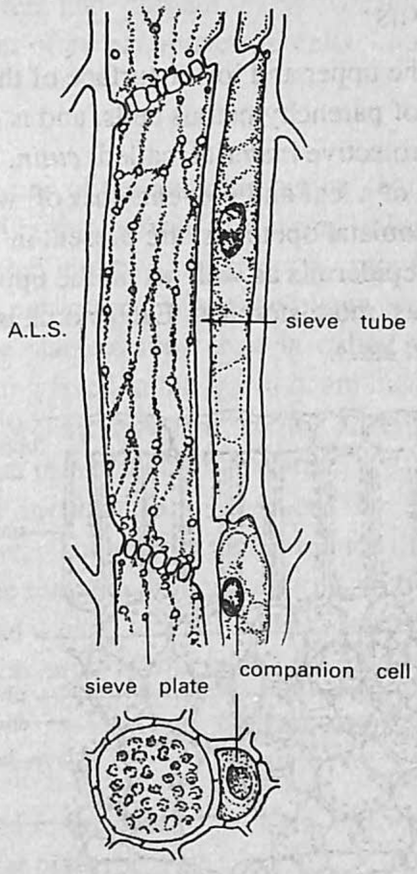

Fig. 2.5 Sieve tube and companion cell

Experiment to show that prepared food is conducted through the phloem: A ring of bark which contains the phloem from the main stem of a big plant is removed. This is known as *girdling*. Girdling blocks the movement of food materials down the stem, which results in the swelling of the tissues above the girdle, due to the accumulation of food. This proves that food materials prepared by the green parts of the plant are conducted downwards through the phloem.

2.4 Anatomy of the leaf

A thin vertical section of a leaf under a microscope will show three types of tissues — *the epidermis*, the *mesophyll* and the *vascular bundles*.

THE EPIDERMIS

This forms the upper and lower surface of the leaf. It consists of a single layer of parenchymatous cells, and is coated with a very thin, waxy and protective material called *cutin*. The epidermis protects the inner tissues of a leaf and prevents loss of water from these tissues. A number of stomatal openings are present in between the epidermal cells in the lower epidermis as well as in the upper epidermis. The lower epidermis has more stomata. Each stoma is guarded by two kidney shaped *guard cells*.

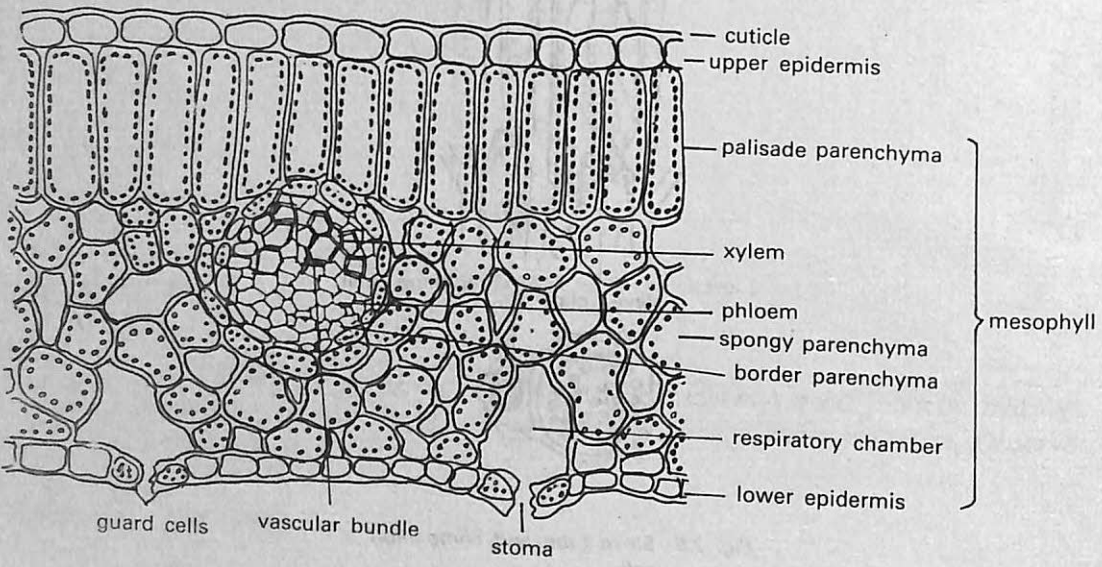

Fig. 2.6 Transverse section of a mesophytic dicot leaf

THE MESOPHYLL

This tissue is present between the upper and lower epidermis. It is differentiated into *palisade* and *spongy parenchyma*. Palisade parenchyma consists of two or three layers of elongated, closely packed cells containing plenty of chloroplasts. The spongy parenchyma lies just below the palisade parenchyma. It consists of oval or round cells, loosely arranged and with numerous intercellular spaces. These cells also contain chloroplasts.

THE VASCULAR BUNDLES

The mesophyll of the leaf consists of a system of vascular bundles which form the veins on the surface of the leaf. Each vascular bundle consists of xylem and phloem. The vascular bundle is surrounded by a compact layer of parenchymatous cells, known as the *bundle sheath.*

2.5 Movement

Movement is one of the most important characteristic features which distinguish living things from non-living things. Plant movements are broadly classified into two categories — movements of *locomotion* and movements of *curvature*. When the plants or parts of the plant body move from one place to another, it is called movement of locomotion. The plants, being fixed to the ground, are incapable of any locomotion. Some of their organs, however, show different kinds of movement which is termed movement of curvature.

Movements in plants are influenced by certain external and internal factors. The factors which induce the movements are called *stimuli* and the reaction of the plant to a stimulus is called *response.* The response of a plant to a stimulus is the result of a fundamental property of the protoplasm called *irritability.*

Movements

Movement of locomotion	Movement of curvature
(In lower plants)	(In higher plants)
e.g., chlamydomonas	e.g., stem tip, root tip, etc.

2.6 Movement in lower plants

Certain algae move about in water with the help of their locomotor organs, called *cilia*, e.g., volvox.

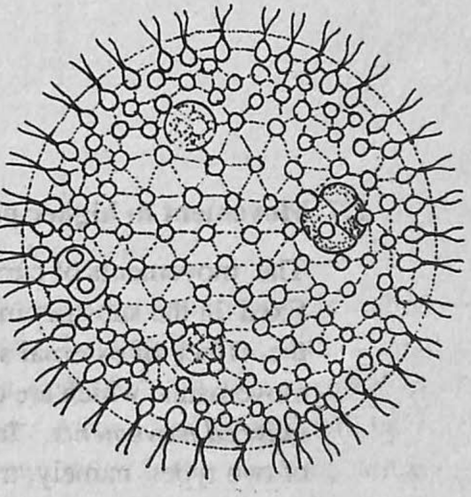

Fig. 2.7 Colonial form of volvox

At the same time some unciliated plants also exhibit locomotion, e.g., diatoms.

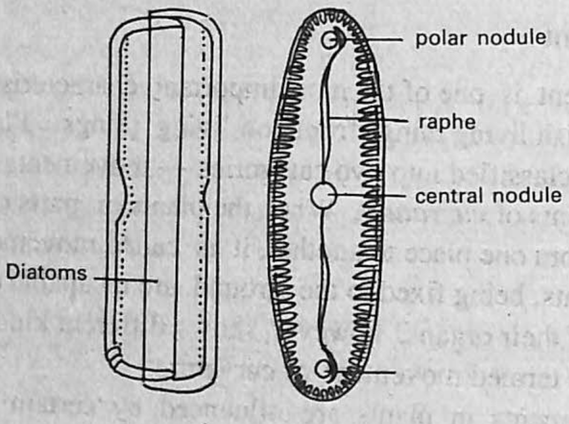

Fig. 2.8 Diatoms

Chlamydomonas, a unicellular green alga found in fresh water, is usually spherical or oval in shape. It has two cilia in the anterior end of the body. There is a lateral red pigment spot called the *eye spot*. The eye spot is sensitive to light. The chlamydomonas swims freely in water by the lashing action of the cilia.

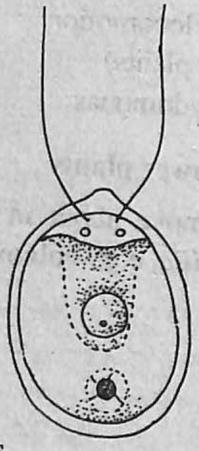

Fig. 2.9 Chlamydomonas

2.7 Movement in higher plants

The movements of curvature are seen in higher plants which are fixed in the substratum. The movements which take place without the effect of external stimuli are called *autonomic movements*. The movements which are caused by some external stimuli are called *induced movements*. Induced movements in higher plants are usually of two types, namely, tropic and nastic movements.

- Movement of curvature
  - Autonomic movement
  - Induced movement
    - Tropic movement
    - Nastic movement

TROPISMS

Tropic movements are induced movements in which the direction of the movement is determined by the direction of the stimulus, e.g., the stem grows towards light, and the root grows towards gravity. Some prominant tropic movements are 1) phototropism, 2) geotropism, and 3) hydrotropism.

Activity 2: *Observe and find out which factor induces growth in the stem tip.*

Phototropism: This is otherwise known as *heliotropism*. Here, the movement of curvature is in response to light. The stem grows towards light so it is positively phototropic. The root is negatively phototropic because it grows away from the light.

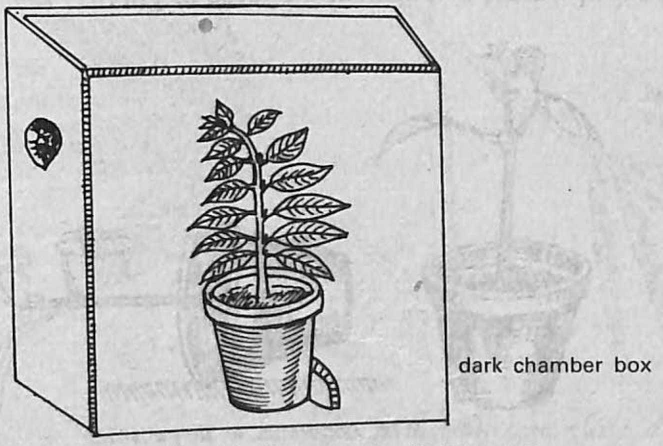

Fig. 2.10 Experiment to demonstrate phototropism

Experiment: The apparatus used to prove phototropism is called the *heliotropic chamber*. It is a rectangular wooden box with a small opening on one side. Light can pass only through this opening. A potted plant is kept inside the chamber. After a few days, it will be found that the stem tip curves and grows towards the opening, since light enters only through that hole. This proves that the stem is positively phototropic.

Geotropism: The movement of plant parts in response to the force of gravity is called geotropism. The primary root grows towards gravity and therefore is said to be positively geotropic.

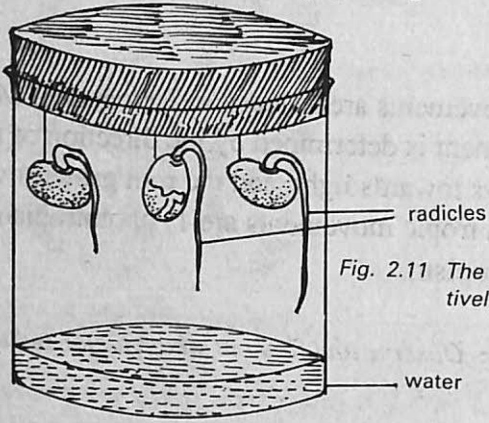

Fig. 2.11 The primary root is positively geotropic.

The main axis of the stem grows away from the force of gravity and hence it is said to be negatively geotropic.

Experiment: A potted plant is placed in the horizontal position. After a few days, the main axis of the stem will be seen to curve and grow upwards, i.e., against the force of gravity.

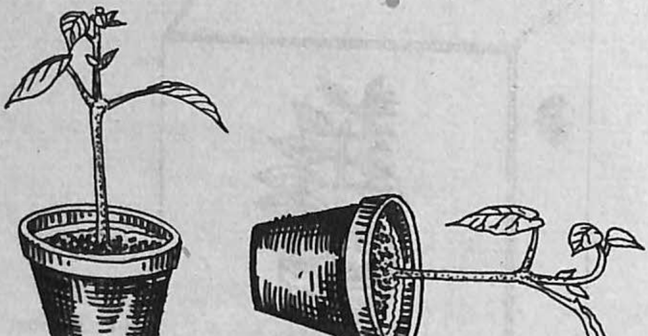

Fig. 2.12 Apparatus to demonstrate negative geotropism

So the stem is negatively geotropic. The root grows vertically downwards, i.e., towards the force of gravity. Therefore, the root is positively geotropic.

Hydrotropism: The movement of the roots in response to the stimulus of water is called hydrotropism.

Experiment: A porous pot is filled with water and is kept in a large container filled with dry saw dust. Some soaked seeds are placed in the saw dust. When they germinate, it will be seen that the roots grow towards the pot of water. Roots thus show movement towards water, i.e., they are positively hydrotropic.

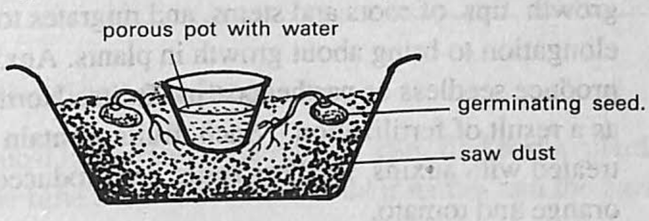

Fig. 2.13 Apparatus to demonstrate hydrotropism

NASTIC MOVEMENTS

Nastic movements are brought about by external stimuli, but the direction in which the movement takes place depends on internal factors. The best example for nastic movement is seen in the touch-me-not plant. If the tip of a leaflet is touched, all the leaflets close up from the tip backwards. The stimulus then passes to the other leaves. If the plant is left undisturbed, the leaflets slowly come back to normal position after a few minutes.

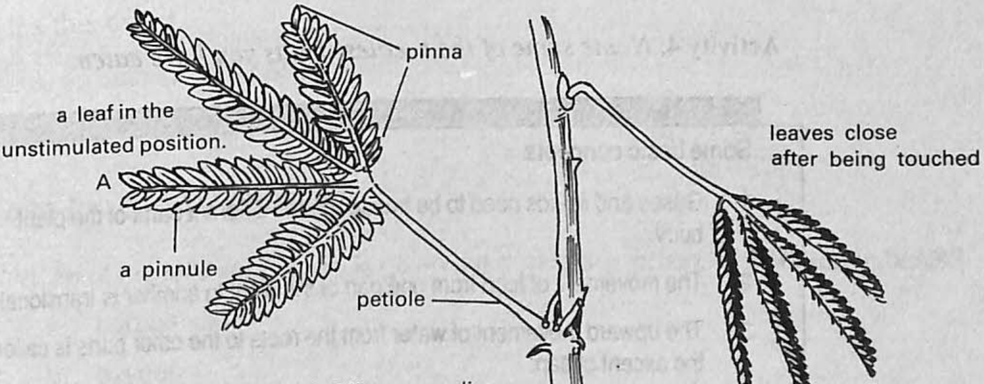
pinna
a leaf in the unstimulated position.
A
a pinnule
petiole
leaves close after being touched

Fig. 2.14 Mimosa pudica

Activity 3: *Observe how the leaves of the rain tree close on touch. Describe what type of movement it is.*

2.8 Co-ordination in plant body by growth regulators

After a number of experiments, it has been proved that there are some chemical substances which have a strong influence on the growth and development of plants. These substances are called *growth regulators*

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or *hormones*. A plant hormone is an organic compound produced in one tissue of a plant and migrates to another tissue where it is required. The imporant plant hormones are 1) auxin, 2) florigen, 3) gibberellin, 4) abscissic acid, and 5) ethylene.

Auxin is the most important plant hormone. It is produced by the growth tips of roots and stems, and migrates to the region of elongation to bring about growth in plants. Auxins are also used to produce seedless or parthenocarpic fruits. Normally a fruit is formed as a result of fertilization. Such fruits contain seeds. If the buds are treated with auxins, seedless fruits are produced, e.g., grapes, papaya, orange and tomato.

Florigen is otherwise known as the flowering hormone, as the production of flowers, fruits and seeds is initiated by this hormone.

Gibberellin brings about rapid elongation of the stems and breaks the dormancy of seeds and buds in plants.

Abscissic acid is a growth inhibitor. It inhibits plant growth and promotes early leaf fall in the plant.

Ethylene is a gas. The substance that is liberated by ethylene is etherel which influences flowering, vegetative growth, maturity and ripening of fruits.

Activity 4: *Name some of the seedless fruits you have eaten.*

Some basic concepts

1. Gases and liquids need to be transported to different parts of the plant body.
2. The movement of food from one part of the plant to another is translocation.
3. The upward movement of water from the roots to the other parts is called the ascent of sap.
4. Vascular bundles consist of xylem and phloem. Water is conducted through the xylem and prepared food is conducted through the phloem.
5. The leaf has three types of tissues— the epidermis, mesophyll and vascular bundles.
6. Plant movement is classified into movements of locomotion and movements of curvature.
7. Plant movements are influenced by certain external and internal factors.

8. Lower plants move with the help of cilia. Higher plants exhibit phototropism, geotropism, hydrotropism and nastic movements.
9. Certain chemical substances called growth regulators have a strong influence on the growth and development of plants.

Some suggested activities / projects

1. Visit a place of botanical importance. See if you can find some plants which close their leaves during the time of sunset. Record their names and the exact time.
2. Make a thin rectangular wooden box. Separate it into two compartments using a thin piece of wood with a small opening in the centre. Place a potted plant inside the first compartment and an illuminated electric bulb in the second compartment.

   Keep the box in a dark room and observe the movements in the plant after three or four days.
3. Soak some bean seeds in water for one day. Keep them wrapped in a wet cloth for two days and then take the germinating seeds out. Place them in a glass vessel half filled with wet sand with the radicles pointing in different directions. After two days observe the growth of the radicles in all the seeds and find out which stimulus influences this event.

REVISION TIME

I. Choose the correct answers:

1. Which of the following gases is given out during the process of photosynthesis?
   - a. carbon dioxide
   - b. oxygen
   - c. nitrogen
   - d. hydrogen
2. The upward movement of water is called
   - a. ascent of sap.
   - b. translocation.
   - c. absorption.
   - d. conduction.

3. When the xylem and phloem form separate bundles, and lie on different radii alternating with each other , the arrangement is said to be
   - a. collateral.
   - b. radial.
   - c. exarch.
   - d. endarch.

4. When the plants or parts of the plant body move from one place to another, it is called
   - a. movement of locomotion.
   - b. movement of curvature.
   - c. migration.

5. Chlamydomonas swims freely in water by the lashing action of
   - a. pseudopodia.
   - b. flagella.
   - c. cilia.

6. Nastic movement is seen in the
   - a. touch-me-not plant.
   - b. spirogyra.
   - c. diatoms.

7. Flowering hormone is another name for
   - a. gibberellin.
   - b. florigen.
   - c. ethylene.
   - d. auxin.

II. Match the following:

1. gibberellin	seedless fruit
2. mimosa	protective material
3. xylem vessels	breaks the dormancy of seeds
4. spirogyra	palisade and spongy parenchyma
5. root hairs	sensitive plant
6. parthenocarpy	green alga

7. mesophyll	sieve tubes and companion cells
8. stem tip	conduction of water
9. phloem	absorption of water and minerals
10. cutin	negative geotropism

III. Fill in the blanks.

1. Xylem is otherwise known as ________________.
2. The first formed xylem is known as ________________, and the xylem formed later is called ________________.
3. ________________ conducts food materials.
4. ________________ are the minute openings present in between the epidermal cells.
5. A compact layer of parenchymatous cells which surrounds the vascular bundles is known as ________________.
6. The response of a plant to a stimulus is called ________________.
7. ________________ is the substance which is liberated by the hormone ethylene.
8. The vascular bundles of the leaves are located in the ______________ of the lamina.
9. The movement of curvature in response to light is called ____________.
10. The movement of roots in response to the stimulus of ________________ is called hydrotropism.

IV. Mark true or false:

1. During respiration carbon dioxide is absorbed and oxygen is given out.
2. When xylem and phloem tissues lie together on the same radius, the arrangement is said to be radial.
3. More stomata are present in the lower epidermis of a leaf.
4. The factors which induce movements in plants are together called response.
5. Diatom is an unciliated plant which exhibits locomotion.
6. Chlamydomonas is a multicellular alga.
7. Roots are positively geotropic.
8. A plant hormone is an organic compound produced in one tissue of a plant.
9. Auxins produce parthenocarpic fruits.
10. Abscissic acid is a growth promoting hormone.

Draw and label the internal structure of a dorsi-ventral leaf.

VI. *Write short notes on the following:*

1. Irritabilty
2. Xylem
3. Phloem
4. Mesophyll
5. Locomotion in chlamydomonas
6. Nastic movements

VII. *Answer the following questions:*

1. What is meant by ascent of sap? Describe an experiment to prove that water is conducted upwards through the xylem.
2. Describe an experiment to show how plants respond to the stimulus of light.
3. How can you prove that the main axis of the stem is negatively geotropic?
4. What are plant hormones? What are their functions?

VIII. *From the following list, pick out the names of the seedless fruits you have studied about.*

1. Banana
2. Papaya
3. Coconut
4. Grapes
5. Tomato
6. cashewnut
7. Apple
8. Pineapple
9. Orange
10. Mango

3. Cellular organisation

cellular organisation - growth - regions of growth - stages of growth - measurement of growth - periodic variation in growth.

The body of any living organism, whether it is a plant or an animal, is made up of a number of minute, microscopic particles called cells. The cell is defined as the structural and functional unit of all living organisms. Life begins from a single cell which comes into being as a result of fertilization. There are many microscopic organisms which continue to be single-celled throughout their life, e.g., amoeba, yeast. They are said to be unicellular organisms. But in the higher forms, the body is composed of numerous cells and such organisms are called multicellular. In the multicellular body, it is not necessary for each cell to perform all the vital functions for itself. But it becomes specialised to perform one particular function. This process of specialisation of single cells in multicellular organisms is called *differentiation.*

If all the cells in a multicellular organism were of the same type and performed the same function, the whole organism would be capable of only a limited number of activities. Many different functions need to be performed for survival. Therefore in multicellular organisms, special groups of cells are developed. Such groups of cells, alike in size, shape, origin and function, are called tissue. A number of tissues make up an organ. All the organs performing a specific function form a system, e.g., the lungs, nose, etc. form the respiratory system.

All living organisms have to grow. We know that the growth in plants differs from that in animals.

Growth in plants does not take place at a uniform rate. There are variations by day and night and also during different seasons.

Activity 1: *Make a list of all the unicellular organisms you have studied so far and prepare a chart with their pictures.*

Growth, one of the characteristic features of living things, may be defined as a permanent increase in the bulk of an organism accompanied by a permanent change of form. It is an irreversible increase in the weight, size or volume of an organism.

Growth in unicellular organisms implies an enlargement of the same cell and increase in weight due to anabolism. But in multicellular organisms, growth means increase in size and weight due to the addition of more cells.

In animals growth takes place throughout the body. But in plants, the growing points are localized and growth takes place mainly at the

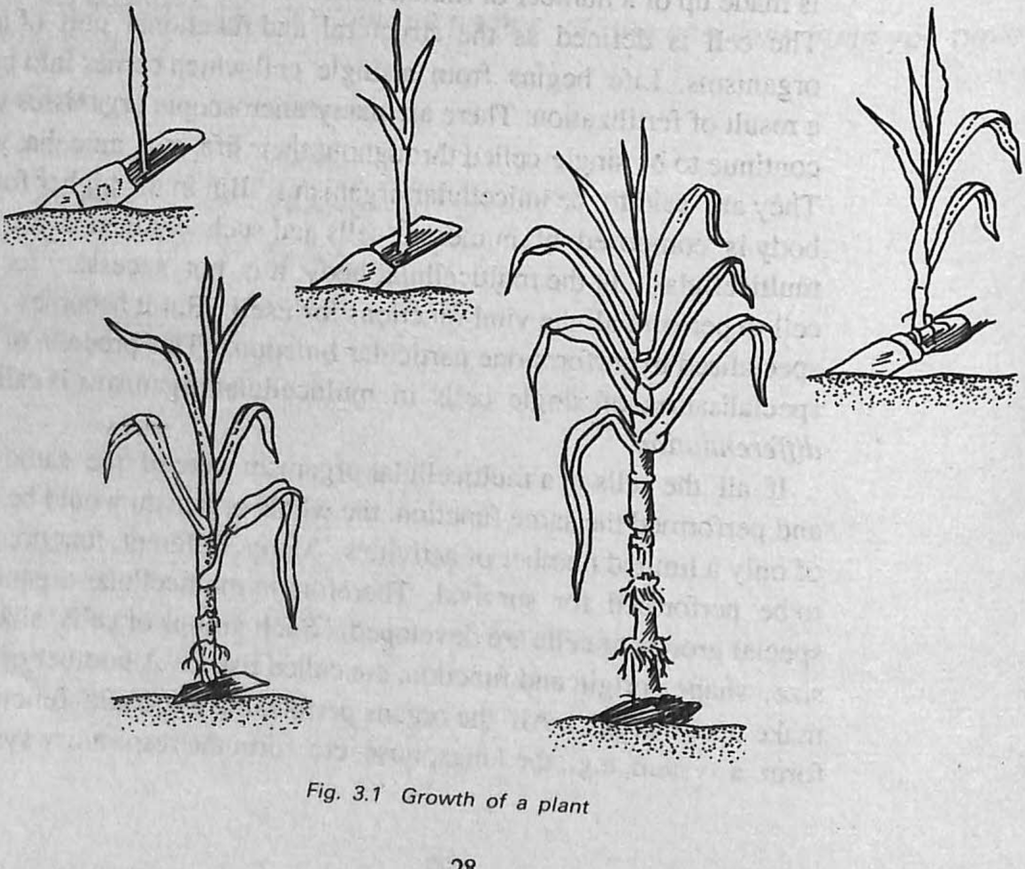


Fig. 3.1 Growth of a plant

tips. The period of growth in animals is definite, i.e., it takes place only for a limited period of time. A plant, however, grows throughout its life span.

REGIONS OF GROWTH

Growth in plants is generally restricted to certain regions of growth called meristems. The apical meristems situated at the tips of the stems and roots are responsible for growth in length. The lateral meristems situated on the sides of the stems and roots are responsible for the increase in thickness. The intercalary meristems present at the nodes are also responsible for the increase in thickness and for the elongation of the axis.

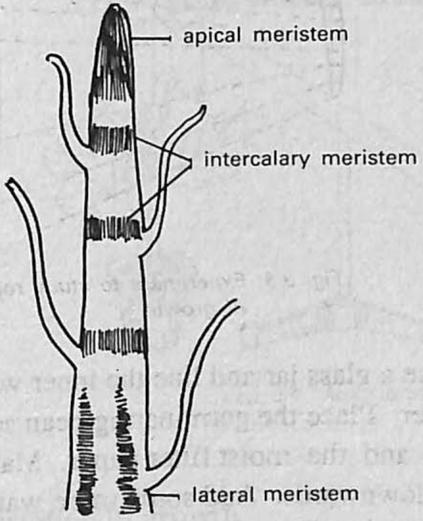


Fig. 3.2 *Position of meristem in a plant*

Actitivity 2: *Select a pet animal and observe its growth. Record this information every three months.*

STAGES OF GROWTH

In the growth of any part of the plant, there are three distinct stages:

1. *Formative stage:* In this stage meristematic cells divide and multiply in large numbers.

2. *Stage of elongation:* In this stage the newly formed cells enlarge in size and elongate.

3. *Stage of maturation:* In this stage the cells and tissues in the root, stem and leaf get differentiated.

Experiment to show the region of growth: Select a germinating bean seed with a straight radicle. Mark the radicle at equal intervals with

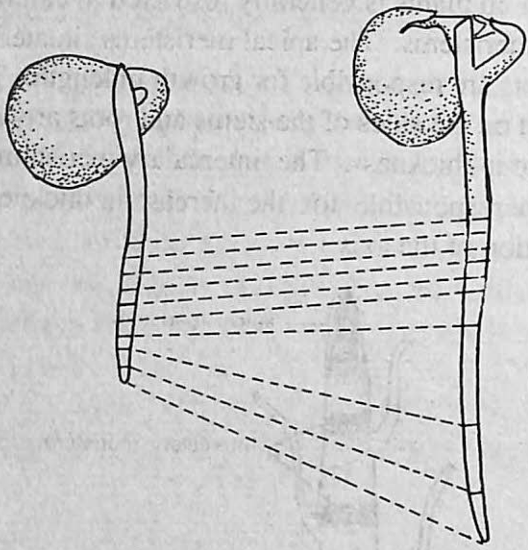


Fig. 3.3 Experiment to study region of growth

Indian ink. Take a glass jar and line the inner wall of the glass jar with moist filter paper. Place the germinating bean seed in between the wall of the glass jar and the moist filter paper. Make sure that the radicle points downwards. Add some more water so that the filter paper is always moist. Examine the seedling after a few days. It will be observed that the lines at a little distance behind the tip have become widely separated whereas the lines in the other regions remain more or less the same. This proves that maximum elongation takes place behind the tip.

MEASUREMENT OF GROWTH

The apparatus used to measure the rate of growth is the lever auxanometer. It consists of a movable lever fixed to a wheel and a graduated arc on a stand. A thread tied to the tip of a stem is passed over the wheel. A small weight is tied at the other end of the thread in order to keep it in tension. As the tip of the stem grows, the weight moves the thread down, which moves the wheel and along with it the needle. The movement of the needle is read on the scale. As the magnification of the scale is known, the amount and rate of growth can be easily calculated.

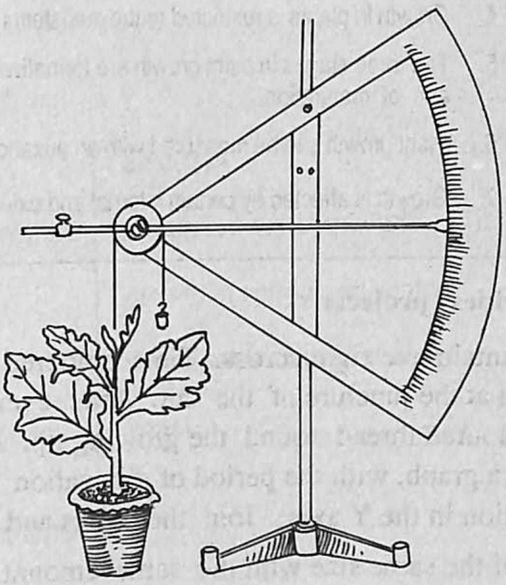


Fig. 3.4 Auxanometer

3.1 Periodic variation in growth

Growth in a cell, organ or an entire plant does not take place at a uniform rate throughout the growing period. When growth starts, it is slow. It increases slowly and reaches a maximum. Then the rate of growth gradually slows down until it stops. This growth period as a whole is known as the *grand period of growth.*

Many external and internal factors operate during this period causing variations in the rate of growth. These variations are called *diurnal variations of growth.* Light inhibits growth and intense light even stops it altogether. This is why plants grow more quickly during the night than during the day.

During the spring season, the rate of growth is high but during winter it is low. These are called *seasonal variations* in growth.

Some basic concepts

1. All living organisms are made up of cells.
2. The process of specialisation of single cells in multicellular organisms is called differentiation.
3. All living organisms grow. Growth in plants differs from growth in animals.
4. Growth in plants is restricted to the meristems.
5. The three stages in plant growth are formative stage, stage of elongation and of maturation.
6. Plant growth can be measured with an auxanometer.
7. Growth is affected by certain internal and external factors.

Some suggested activities / projects

1. Cut a young plantain tree right across. Tie a coloured twine around the stump, immediately, just at the juncture of the cut. After every three hours make slight cut marks or tie a coloured thread round the growing tip. After observing this for a few times, make a graph, with the period of elongation (time) in the X axis, and the length of elongation in the Y axis. Join the points and study the growth rate.
2. Fill three pots of the same size with the same amount of wet sand. Place an equal number of green gram seeds in all the three pots. Place one pot in direct sunlight, the other under a big shady tree and the third one in your room. Keep them in a uniform state of nourishment. Observe the periodic variation in their growth.

REVISION TIME

I. Fill in the blanks:

1. The bodies of all living organisms are made up of ______________ .
2. Amoeba and yeast are said to be ______________ organisms.
3. ______________ is defined as a permanent increase in the bulk of an organism.
4. Growth in unicellular organisms is an enlargement of the same cell due to ______________.
5. Growth in animals is ______________.

6. Growth in plants is restricted to growing points called __________.

7. The __________ meristems are present at the nodes.

8. __________ is the apparatus used to measure the rate of growth in plants.

9. The growth period as a whole is known as the __________ of growth.

10. During the __________ season, the rate of growth is high, but during __________ it is low.

II. *Match the following:*

1. cell	an organ
2. unicellular organisms	measurement of growth
3. group of tissues	growth in spring and winter
4. auxanometer	structural and functional unit
5. seasonal variations in growth	yeast

III. *Choose the correct answer:*

1. The structural and functional unit of living organisms are __________ (tissues / cells).

2. In higher plants, the plant body is composed of numerous cells and are called __________ (multicellular/unicellular).

3. Growth in animals is __________ (definite/indefinite).

4. Apical meristems are situated __________ (at the tips of the stem and root/ at the sides of the stem and root).

5. During winter, the growth is __________ (high/low).

IV. *Say whether the following statements are true or false:*

1. Multicellular organisms are made up of only one cell.

2. A group of cells of the same size, shape, origin and function are said to be an organ.

3. Growth in animals takes place throughout their life span.

4. During the stage of maturation, the cells divide and elongate.
5. Plants grow very slowly in the night.

V. *Define the following:*

1. Cell
2. Tissue
3. Growth
4. Grand period of growth

VI. *Answer the following questions:*

1. How does growth take place in unicellular and multicellular organisms?
2. Where does growth actually take place in plants?
3. Explain an experiment to demonstrate the regions of growth.
4. How can you measure the rate of growth?
5. What is meant by seasonal variations in growth?

4. Nutrition and hygiene

need of food for plants - need for carbon dioxide, water and minerals as well as sunlight for the preparation of food in plants with simple examples - spoilage of food - role of bacteria and fungi in the spoilage of food - cleanliness and hygiene in purchase of food items - prevention of food spoilage, use of preservatives and closed containers - heating - cooling - use of preservatives such as salt, sugar and oil - usage of adulterants by unscrupulous business men - survival without food - special methods of procuring food in plants, pitcher plant, bladderwort.

Nutrition is the ingestion of food and acceptance of nourishment from the food taken for maintenance, growth, energy and the total well being of the body of a living being. Proper nutrition prevents diseases, promotes growth and maintains the systems of the body. Food supplies certain essential substances called *nutrients*. They build body cells and help in the growth and repair of the body cells. They provide energy for various activities without doing any harm to the body.

On the basis of modes of nutrition, plants are broadly classified into *autotrophs* and *heterotrophs*. Green plants make their own food by the process of photosynthesis. Some plants are *carnivorous* as they consume insects as food.

There are certain microorganisms which are responsible for the spoilage of food substances. Food items should therefore be purchased from clean places where there is no chance of contamination with any kind of microorganisms.

4.1 Need of food for plants

When you walk, run or move your muscles, you are performing an action. A motor car cannot move without fuel. Human beings, too, need energy to do work. The fuel that gives us energy is the food we eat. In the same way, plants also need energy to carry out vital functions like growth, movement, reproduction, etc. The energy which is required to perform these functions is obtained from the food materials they synthesise.

All living things grow. There is a difference in the growth of unicellular and multicellular organisms. In the unicellular organisms, growth is accomplished by the enlargement of the single cell. In multicellular organisms, growth takes place by the multiplying of the number of cells present in the body. Living things are made up of a complex living substance called protoplasm. During the process of growth, cells have to accumulate more protoplasm. Food substances get transformed into protoplasm. Food materials like carbohydrates, proteins and fats which are indispensable are drawn from regions like the leaves where they are prepared or from the roots or stems where they are stored.

Food is also essential to replace all the worn out parts or for repairing various parts of the body.

Activity 1: *Observe all the living things in your school garden. Prepare separate lists of plants and animals. How do these living things get their food?*

4.2 Need for carbon dioxide, water, minerals and sunlight

We are aware that all living things need food to maintain life. Animals can take in complex food substances. Plants can manufacture their own food from simple substances and are therefore said to be autotrophic in their mode of nutrition.

Green plants possess a green pigment called chlorophyll. With the help of solar energy which is absorbed by chlorophyll, the green parts of the plant manufacture carbohydrates from carbon dioxide and water. Photosynthesis is, therefore, a process by which the green parts of the plant manufacture carbohydrates from carbon dioxide and water in the presence of light.

CONDITIONS NECESSARY FOR PHOTOSYNTHESIS

The raw materials required for photosynthesis are carbon dioxide and water. *Water* is absorbed from the soil by the root hairs. *Carbon dioxide* is obtained from the atmospheric air. Chlorophyll, present in the green parts of the plant, acts as a catalyst. *Solar energy* which is another requirement is trapped by the chloroplasts.

THE PROCESS OF PHOTOSYNTHESIS

The process consists of two stages: light reaction and dark reaction.

Chlorophyll absorbs energy from sunlight and uses this energy to synthesise food. It splits up water molecules into hydrogen and oxygen by a process called *photolysis*. The hydrogen thus formed is used to reduce carbon dioxide to form a simple sugar called glucose.

The oxygen formed during the photolysis of water diffuses out of the mesophyll cell and escapes into the atmosphere. The overall process may be written in the form of an equation.

$$\boxed{6\,CO_2 + 12\,H_2O \xrightarrow[\text{Chlorophyll}]{\text{light energy}} C_6H_{12}O_6 + 6\,O_2 + 6\,H_2O}$$

Activity 2: *Take a green leaf from a plant which has been exposed to sunlight for a few hours. Put the leaf in boiling water to kill the tissues. Then place the leaf in warm alcohol which bleaches the leaf. Treat the leaf with iodine solution. You will see that the leaf turns dark blue in colour. Iodine is a chemical substance which turns blue when it comes in contact with starch molecules. This proves that starch is formed during photosynthesis.*

Activity 3: *Take a few cuttings of a hydrilla plant and put them in a glass funnel. Place the funnel in a beaker of water. Add more water so that the tip of the stem of the funnel is completely immersed in water. Fill a test tube with water and invert it over the stem of the funnel taking care to see that no air enters the test tube. Add some sodium bicarbonate to the water. Leave the apparatus in sunlight. Within a few minute you will see bubbles arising from the plant and collecting in the inverted test tube. When sufficient gas has been collected remove the test-tube from the apparatus and introduce a glowing splinter into it. The glowing splinter will be rekindled. This proves that the gas which came up and collected in the test tube is oxygen. This oxygen had been released by the plant during the process of photosynthesis.*

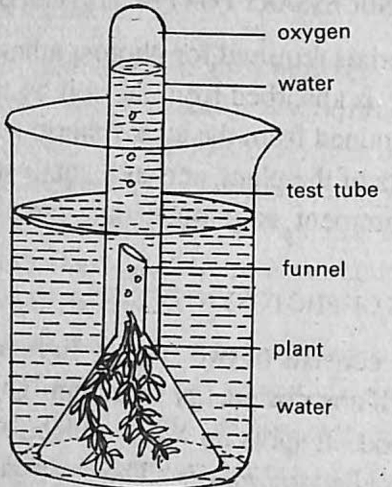


Fig. 4.1 Experiment to prove the evolution of oxygen during photosynthesis

Activity 4: *Keep a potted plant in a dark room for 24 hours so that the leaves lose their starch. Take a wide mouthed bottle with a tight fitting cord split into two halves. Put a few pellets of potassium hydroxide in the bottle. Take a leaf from that plant and place the leaf between the two halves of the cork so that the upper half of the leaf projects into the bottle and the other half is outside the bottle. Dip the stalk of the leaf in a small vessel of water. Leave the set-up in sunlight for 4-6 hours.*

Remove the leaf from the bottle and test it for starch. Only the portion of the leaf which projects outside the bottle turns blue black. As potassium hydroxide has absorbed all the carbon dioxide present in the bottle, the part of the leaf which is kept inside the bottle could not get carbon dioxide and no starch was produced. This proves that carbon dioxide is essential for photosynthesis.

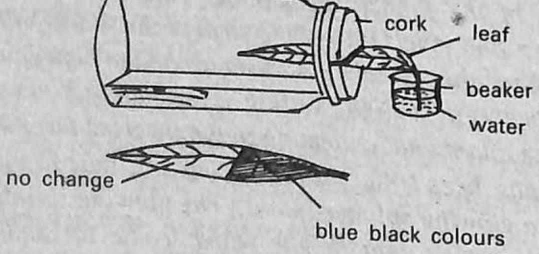


Fig. 4.2 Experiment to show that CO_2 is necessary for photosynthesis.

Activity 5: *Select a potted plant. Keep it in a dark room for 24 hours in order to make the leaves starch free. Take two pieces of thick black paper and a clip. Select a leaf from the plant and place the two pieces of black paper one above and the other below the leaf by using the clip.*

Leave the plant in sunlight for 4-5 hours. Remove the leaf from the plant and test for starch. It will be seen that only the portion which is exposed to sunlight becomes dark blue in colour, showing the presence of starch. The other part which had been covered by black paper shows no signs of starch. This proves that sunlight is essential for photosynthesis.

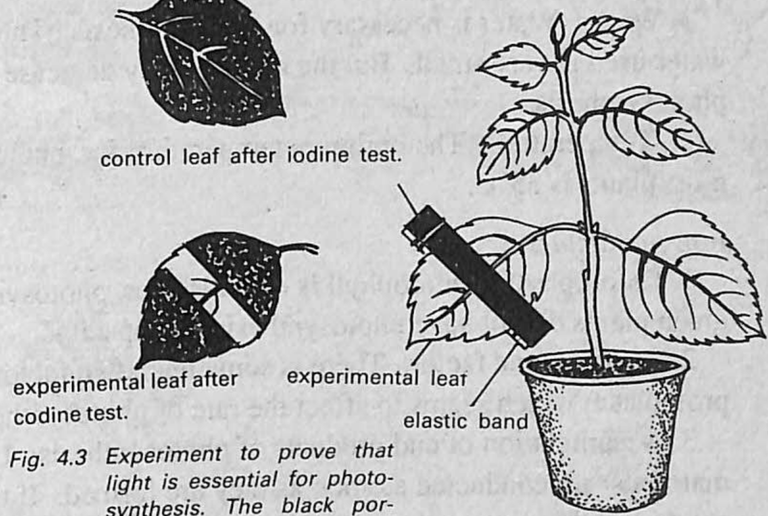
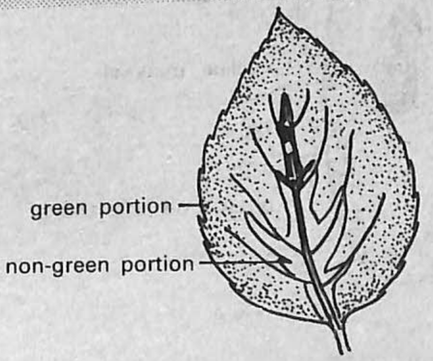
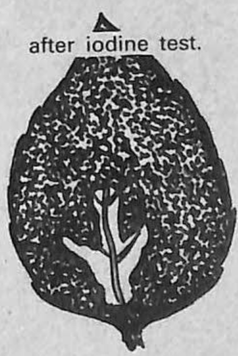


Fig. 4.3 Experiment to prove that light is essential for photosynthesis. The black portions indicate the presence of starch.

Activity 6: *Take a potted croton plant with variegated leaves. The leaves of this plant do not have chlorophyll distributed all over their entire lamina; but it is present only in patches. Keep the plant in a dark room for 24 hours to make the leaves starch free.*

Place the plant in sunlight for 4-6 hours. Now remove a leaf from that plant and mark out the patches of chlorophyll. Test the leaf for starch. It will be seen that the leaves turn blue black wherever chlorophyll is present. This proves that chlorophyll is essential for photosynthesis.





FACTORS AFFECTING PHOTOSYNTHESIS

The factors affecting photosynthesis may be classified into external and internal factors.

External factors:

1. Light: Light is essential for photosynthesis. An increase in the intensity of light increases the rate of photosynthesis.

2. Carbon dioxide: Carbon dioxide is the source of carbon for the organic compound formed in the plant.

3. Water: Water is necessary for photosynthesis. The amount of water used is very small. But the absence may decrease the rate of photosynthesis.

4. Temperature: The optimum temperature for photosynthesis in most plants is 35°C.

Internal factors:

1. Chlorophyll: Chlorophyll is essential for photosynthesis. Non-green plants do not have photosynthesizing capacity.

2. Protoplasmic factor: There is some unknown factor within the protoplasm which seems to affect the rate of photosynthesis.

3. Accumulation of end products of photosynthesis: Usually food materials are conducted as soon as they are formed. If they are not conducted they accumulate there itself. This accumulation of end products may decrease the rate of photosynthesis.

4.3 Role of bacteria and fungi in the spoilage of food

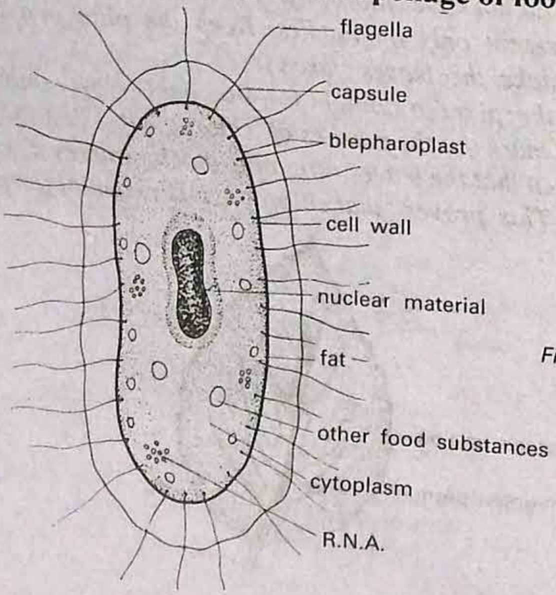


Fig. 4.5 Ultrastructure of bacterial cell.

Food kept open at ordinary room temperature gets spoiled quickly. The principal agents that spoil food are microorganisms such as bacteria and fungi. Some saprophytic bacteria cause decay of human foodstuffs and make them unpalatable. The spoilage of butter, vegetables, fruits and rotting of meat, etc. are because of bacterial activity.

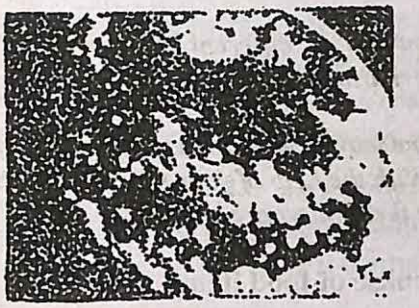


Fig. 4.6 Fungi growing on an apple.

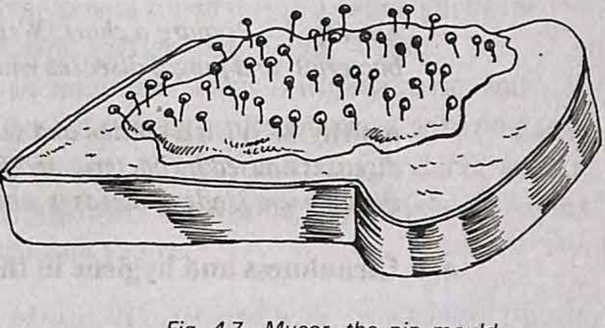


Fig. 4.7 Mucor, the pin mould.

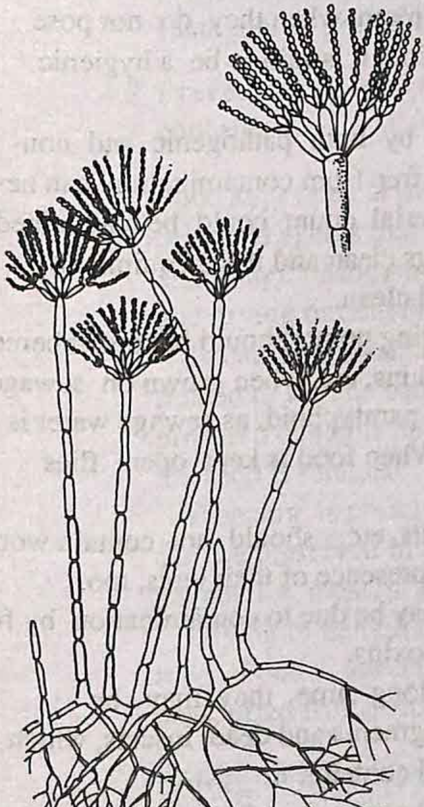


Fig. 4.8 Mycelium of penicillium

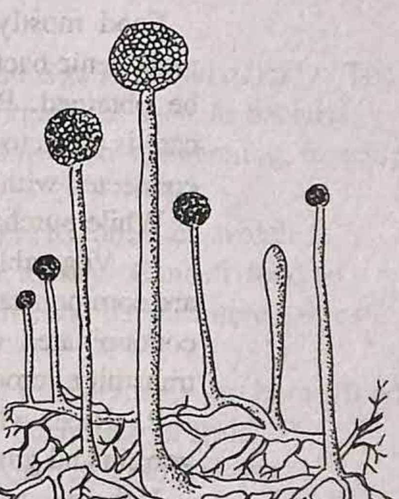


Fig. 4.9 Mycelium of mucor

Some bacteria produce toxins in food causing food poisoning. Food poisoning is called *Ptomaine poisoning*. *Botulism* is one of the most serious types of food poisoning.

Some fungi are found on exposed foodstuffs and they bring about their decay. Fungus spoils food grains during storage. Many species of penicillium attack and destroy fruits like citrus and apples.

Activity 7: *Prepare a chart. Write the names of different kinds of bacterial and fungal diseases which are harmful to plants.*

Activity 8: *Visit a garden and select some leaves which have symptoms of diseases caused by bacteria and fungi. With the help of your teacher, identify the different kinds of diseases caused by these microorganisms.*

4.4 Cleanliness and hygiene in the purchase of food items

Strict hygiene should be maintained at all stages of handling food. When microbial counts are at a minimum, when they do not pose chances of infection and contamination, it is said to be a hygienic condition.

Food mostly gets contaminated by both pathogenic and non-pathogenic bacteria. Foods entirely free from contamination can never be obtained. But a minimum bacterial count could be maintained if care is taken to keep the surroundings clean and if the equipment connected with food is sterilised and clean.

While purchasing food the following points should be remembered:

1. Vegetables like greens, pumpkins, etc. when grown on sewage are common carriers of typhoid and paratyphoid, as sewage water is contaminated with faecal matter. When food is kept open, flies transmit microorganisms.

2. Rice, wheat, dhals, groundnuts, etc. should not contain worms, vermin and gnats as this means the presence of their eggs, too.

If there is any discolouration it may be due to contamination by fungi and moulds which release harmful toxins.

If the pulses are stored for a long time, they may be contaminated by excreta, insect fragments and dead insects, which also affect the nutritive value of the food contents.

3. The shells of eggs should not be coated with the faecal matter of the bird as faecal matter is infested with pathogenic organisms.

4. Fish, when brought from places where sewage water is emptied,

will contain parasites like amoeba, eggs of ascaris, hookworm, etc.

5. One must ensure that meat is fresh and not obtained from dead animals.

6. Milk is a highly nutritious and easily digestible food, but can also be contaminated very easily by human hands and the cows' udders.

7. When tinned or canned meat and fish are purchased, dents and bulges on the cans should be looked for as this is a sure sign of the presence of the spores of *Clostridium botulinum.* These microorganisms produce an endotoxin which is highly toxic and found in dirty water. The cans should be sealed properly with no gaps and the tins should be free of rust. If meat and fish products are not boiled prior to canning, the organism *Clostridium perfiringens* begins to thrive as it forms heat-resistant spores.

Activity 9: *Take two dishes of food. Handle one with dirty hands. Do not touch the other food at all, but handle the dish with clean hands and use a clean spoon. See which one gets spoilt quickly.*

4.5 Prevention of food spoilage, use of preservatives and closed containers

Food kept open at ordinary room temperature gets spoiled quickly. The principal agents that spoil food are microorganisms such as bacteria and fungi. Modern methods of preserving food are canning, freezing and drying or dehydration.

In canning, fresh foodstuffs are packed in a container which is treated to kill the bacteria and sealed immediately. Canned food so prepared contains no living microorganisms, and the nutritive value of the food is retained.

Freezing is preservation by lowering of temperature. At home, food can be preserved in a refrigerator. Large quantities of fruits, vegetables, meat, grains and fish can be stored in cold storages.

Drying or dehydration is another method to prevent the spoiling of food. Food is dried under controlled conditions. Dried milk, dried peas, dried fruits, etc. can be stored for many months.

Activity 10: *List all the uncooked items of food that you can see around you and indicate the importance of each of these in our diet. How are these items to be protected from getting spoilt?*

4.6 Heating, cooling, use of preservatives

Food kept in closed containers will last longer as the germs and insects present in the surroundings will not be able to contaminate this food.

Heating kills many germs. We heat milk to prevent it from spoiling. Many food items can be preserved simply by drying them in the sun.

Bacteria do not grow and multiply in the cold. That is why food kept in ice boxes lasts longer. Fish and meat are transported to far off places in special cold containers.

Some items of food that are easily spoiled can be preserved by adding salt, sugar, oil or vinegar. By this method, we can slow down the growth of bacteria.

Sometimes, special chemicals are added to food items as preservatives. Sodium metabisulphite is added to jams, juices and jellies to keep them from spoiling.

Activity 11: *Prepare a list of the various methods of storing and preserving potato, banana and tapioca.*

4.7 Usuage of adulterants

Adulteration of food stuff is widely practised by tradesmen all over India in order to make profit illegally. In order to protect the health of the consumer or buyer the Government of India constituted the *Prevention of Food Adulteration Act,* in 1954. Central food laboratories were established under this Act, first in Calcutta and later in Mysore for the southern regions. *A Central Committee for Food Standards* has also been set up under this Act to advise the Central Government on matters relating to food standards. Food inspectors have been appointed, testing laboratories set up with food analysts and public analysts appointed to conduct tests and report on suspected foods.

ADULTERATED FOOD

According to the Prevention of Food Adulteration Act, an article of food shall be called adulterated:

1. if the article sold by the vendor is not of the nature, substance or quality demanded by the purchaser;

2. if any inferior or cheaper substance has been substituted wholly or in part for the article which makes the article poisonous or injurious to health;
3. if any constituent of the article has been removed wholly or in part making it injurious or affecting its quality;
4. if the article has been prepared, packed or kept under insanitary conditions whereby it has become contaminated and is injurious to health;
5. if false claims are made on the label of the packed or tinned item;
6. if the article contains filthy, rotten, decomposed or diseased animal or vegetable matter or it is insect infected and unfit for human consumption;
7. if any colouring matter other than that prescribed and in amounts not within the prescribed limits is present in the article;
8. if the article contains any prohibited preservatives or sweeteners in excess of prescribed limits; and
9. if the constituents of the substance are present in quantities which are in excess of the prescribed limits.

COMMON ADULTERANTS IN DIFFERENT FOODS

1. Milk and milk products: Addition of water to milk, removal of a part of the fat as cream, reconstituted skimmed milk mixed with pure milk, hydrogenated vegetable oil added to skimmed milk, milk powder mixed with dextrin powder or soluble starch and ghee adulterated with vanaspathi or oil fats.

2. Vegetable oils and fats: Cheap edible and non-edible oils, such as linseed oil, cottonseed oil and mineral oils and industrial chemicals used to adulterate costly vegetable oils and fats.

3. Wheat products: Tapioca flour and tapioca suji used to adulterate wheat flour and wheat semolina, respectively.

4. Pulses: Kesari dhal coloured with coal tar dye used to adulterate Bengal gram dhal and red gram dhals.

5. Honey: Coloured sugar syrup passed off as honey.

6. Beverages: Coffee powder adulterated with powdered roasted bran, roasted date and tamarind seeds, and tea adulterated with exhausted tea leaves or leaves of other plants.

7. Spices and condiments: Asafoetida adulterated with vegetable gums and resins, turmeric coated with lead chromate or coal tar dyes, starch coloured brown with dyes added to curry powder, mustard with argemone seeds and black pepper with papaya seeds.

FOOD STANDARDS

1. The International Codex Alimentation Commission is the organization which operates jointly with the Food and Agriculture Organization (FAO) and the World Health Organization (WHO).
2. Prevention of Food Adulteration Act (1954).
3. Fruit Products Order (1961) which sets the standard for the quality of fruit and vegetable products, issuing licence before starting production and during supply.
4. The grading and marketing of Agricultural Products Act (1937) which defines the standard for the quality of agricultural products like cereals, oil seeds, butter, ghee, eggs, etc.

4.8 Survival without food

Some living organisms have the ability to survive without food during unfavourable seasons. This is known as *hibernation.* During the winter season, the polar bear sleeps for months together and when spring time arrives it wakes up. The energy it needs during winter comes from the fat that is stored in its body. It eats enormously before winter and stores up the energy as fat.

In the case of the toad, it reduces all its movements and activities during the winter and summer seasons. The animals bury themselves in mud or hide beneath rocks. The winter sleep of this animal is called hibernation while the summer sleep is known as *aestivation.*

Another example of a hibernating animal is the amoeba. In unfavourable conditions, when the ponds in which it lives dry up, it suspends all its activities. It forms a cyst and sleeps inside the cyst. This cyst consists of non-protoplasmic substance, and is formed by the surface protoplasm by a chemical change, and the process is known as *secretion*. When there are favourable conditions the cyst ruptures, and the organism comes out to lead its normal life.

In plants also, the growth of the seed is stopped when environmental conditions are not favourable for germination. Such seeds, which are in the resting stage, are said to be dormant. Dormancy helps the seeds to survive during unfavourable conditions like drought or very hot and very cold seasons. The seed, at this stage, contains a very small quantity of water, just enough to keep the seed alive.

4.9 Special methods of procuring food in plants

Green plants are autotrophic or self-nourishing plants. On the other hand, non-green plants are heterophic. Such plants cannot prepare carbohydrates and nourish themselves. They get their supply of carbohydrates from different sources. Heterotrophs may further be classified into parasites, saprophytes, symbionts and insectivores.

1. PARASITES

Parasites feed on the bodies of other living organisms which are called hosts. They take in food that has already been digested.

Parasites are of two kinds, 1. total parasites, and 2. partial parasites.

Total parasites have no chlorophyll of their own and depend totally on their hosts for food, water and mineral salts, e.g., dodder (cuscuta).

Partial parasites or semi-parasites, on the other hand, are green in colour and are, therefore, not entirely dependent on the host plant. They absorb water and salts from their hosts and make most of their own food, e.g., viscum.

Some fungi are also parasites.

2. SAPROPHYTES

Saprophytes grow on decaying animal or vegetable matter, and absorb food from their bodies, e.g., mushrooms.

3. SYMBIONTS

Two completely different living organisms which live in close association with each other and get mutual benefit are called symbionts. The condition is known as symbiosis, e.g., lichen.

4. INSECTIVORES

Insectivorous plants are otherwise called carnivorous plants. These plants mostly grow in places where there is nitrogen deficiency. Their root system is poorly developed. While photosynthesis goes on, such plants cannot synthesize their own proteins and therefore add to their supply of nitrogenous foods by capturing insects, killing and digesting them and absorbing the products through the leaf surfaces. Hence they are called insectivorous or carnivorous plants.

About 450 species of carnivorous plants have till now been identified, representing 15 genera belonging to five or six families, out of which over 30 species occur in India, e.g., Drosera.

Nepenthes: It is otherwise known as the pitcher plant. The pitcher is a modification of the petiole, and the laminated structure that of the leaf base. This plant is a climbing herb. When it is young the mouth of the pitcher remains closed by a lid which afterwards opens and stands

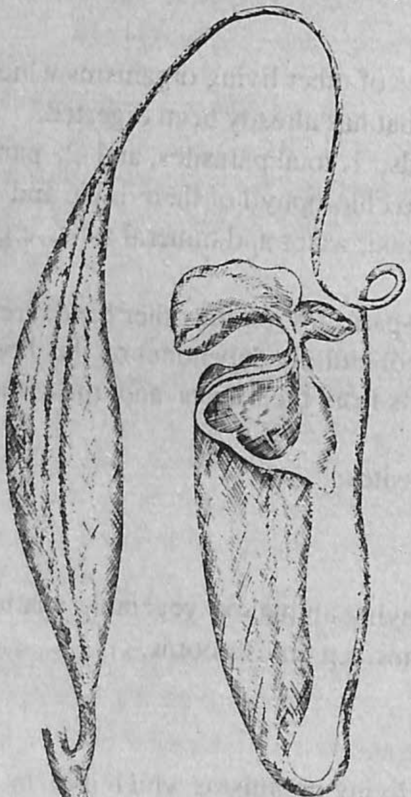


Fig. 4.10 Pitcher plant-an insectivorous plant

more or less erect. The lid is often bright red in colour and serves to attract insects. Below the mouth, the inside of the pitcher is covered with numerous smooth hairs, all pointing downwards. There are numerous large digestive glands present inside the pitcher. The insect, attracted by the bright colour and scent of the lid, slips down the inner smooth surface. The glands secrete more digestive juices within the pitcher. The insects, which are unable to escape, are consumed and digested by the juices present within the pitcher. The necessary nutrients are absorbed.

Utricularia: This is the bladderwort plant which is mostly a floating or slightly submerged, rootless, aquatic herb. The leaves are highly segmented, and these simulate roots but they are green in colour. Some of these segments become transformed into bladders.

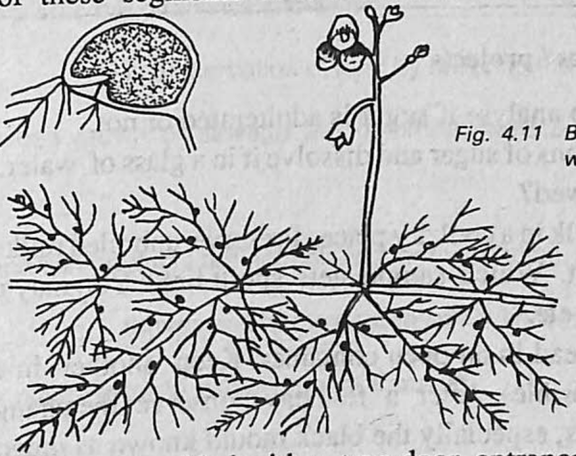


Fig. 4.11 Bladderwort (Utricularia) with many small bladders.

Each bladder is provided with a trap-door entrance. The door acts as a sort of valve which can be pushed open inwards from outside, but never the other way. Very small aquatic insects enter the bladder and the valve shuts itself automatically. The numerous digestive glands present inside the bladder secrete the digestive enzyme and absorb the digested food substances.

Some basic concepts

1. Nutriton helps to build body cells and provides energy for various activities.
2. Based on the mode of nutrition, plants are divided into autotrophs and heterotrophs.
3. Certain microorganisms are responsible for the spoilage of food substances.

4. Plants, with the chlorophyll they possess, solar energy, water and carbon dioxide, prepare their own food by photosynthesis.
5. Photosynthesis comprises light reaction and dark reaction.
6. Certain external and internal factors affect photosynthesis.
7. While buying food stuffs, certain precautions must be taken.
8. There are various methods of preserving food, e.g., canning, freezing, drying, etc,. and use of heating, cooling and preservatives.
9. There are laws to prevent adulteration of food.
10. Some organisms can survive without food for a certain period, e.g., polar bear during hibernation.
11. The three kinds of heterotrophs are parasites, saprophytes and symbionts.

Some suggested activities / projects

1. Do a simple test to analyse if sugar is adulterated or not.
   Take three teaspoons of sugar and dissolve it in a glass of water. What do you see after the sugar is dissolved?
2. Preserve boiled milk in a cool dry place. Preserve unboiled milk in a cool and dry place away from the first. Which sample gets spoilt first? You may name the samples as A and B or 1 and 2, etc.
3. Keep a slice of bread in an open container. Keep another in the bread box (in the refrigerator, if possible). After a few days, observe the change in colour due to the growth of moulds, especially the black mould known as mucor.

REVISION TIME

I. Match the following:

1. Food materials	saprophyte
2. Botulism	hibernation
3. Dodder	resting period of seeds
4. Viscum	bladderwort
5. Lichens	traps light energy
6. Mushroom	partial parasite
7. Utricularia	algae and fungi

8. Polar bear	carbohydrates, fats and proteins
9. Chlorophyll	food poisoning
10. Dormancy	total parasite

II. *Fill in the blanks.*

1. Chlorophyll is capable of absorbing ________________ energy.
2. Chlorophyll acts as a ________________ in the process of photosynthesis.
3. ________________ is one of the most serious types of food poisoning.
4. Many species of ________________ attack and destroy fruits like citrus and apples.
5. Cuscuta is a ________________ parasite.
6. Insectivorous plants are otherwise known as ________________ plants.
7. ________________ is preservation of food by lowering the temperature.
8. Vegetables when grown on sewage are common carriers of ________________ and ________________.
9. If meat and and fish products are not boiled prior to canning, the organism ________________ thrives and forms heat resistant spores.
10. Insectivorous plants grow in places where there is ________________ deficiency.

III. *Mark true or false:*

1. In unicellular organisms, growth is accomplished by the enlargement of the single cell.
2. Only green plants are autotrophic in their mode of nutrition.
3. Living and non-living things are made up of protoplasm.
4. The only raw materials needed for photosynthesis are oxygen and water.
5. The process of photosynthesis consists of light reaction and dark reaction.
6. The optimum temperature for photosynthesis in most plants is 35° C.
7. Food kept in a closed container at ordinary room temperature gets spoiled quickly.
8. Parasites and saprophytes are heterotrophs.
9. Only one organism benefits in symbiosis.
10. The lid in the pitcher plant is bright red in colour and serves to attract insects.
11. Utricularia is a rooted terrestrial plant.

12. Tapioca flour is used to adulterate wheat flour.
13. Drying is the only method to prevent spoliage of food.
14. Heating kills many germs.
15. Sodium metabisulphite is used as a preservative.
16. Bacteria can grow and multiply in the cold.
17. No living organism has the ability to survive without food during unfavourable seasons.
18. Summer sleep in the toad is known as aestivation.
19. Dormancy is the active stage of the seed.
20. Foods are mostly contaminated by both pathogenic and non-pathogenic bacteria.

IV. Choose the correct answer:

1. Photolysis is the
   a. splitting of carbon dioxide.
   b. splitting of water molecules into hydrogen and oxygen.
   c. union of hydrogen and hydroxyl ions.
2. The chemicals produced by some bacteria causing food poisoning are
   a. growth promotors.
   b. insecticides.
   c. toxins.
3. Parasites feed on the bodies of other
   a. living organisms.
   b. non-living organisms.
   c. living and non-living organisms.
4. Nepenthes is otherwise known as
   a. dodder.
   b. pitcher plant.
   c. bladderwort.
5. Each bladder in utricularia is provided with
   a. a mouth closed by a lid.

   b. a mouth covered inside by numerous downwardly projecting hairs.
   c. a trap-door entrance.

6. Canned food contains
   a. a few living microorganisms.
   b. many living microorganisms.
   c. no living microorganisms.

7. Fish and meat are transported to far off places
   a. in special hot containers.
   b. in special cold containers.
   c. in refrigerators.

8. The polar bear stores
   a. carbohydrates.
   b. proteins.
   c. fats.

9. The process of formation of cyst in amoeba is known as
   a. hibernation.
   b. encystment.
   c. aestivation.

10. Vegetables grown on sewages are carriers of
   a. typhoid and paratyphoid.
   b. cold and fever.
   c. mumps and measles.

V. *Describe the following in one or two sentences:*

1. Photosynthesis
2. Photolysis
3. Symbiosis
4. Chloroplast

5. Autotrophs
6. Adulteration of food
7. Insectivores

VI. *Answer the following questions:*

1. Why do living organisms take food?
2. Describe an experiment to demonstrate that oxygen is produced during photosynthesis.
3. Explain briefly how you can prove that carbon dioxide is essential for photosynthesis.
4. What are the factors which affect the rate of photosynthesis?
5. How does food get spoiled?
6. Explain the different methods of storing and preserving food materials.
7. What is adulterated food?
8. Explain hibernation with reference to the polar bear.
9. Describe the pitcher plant and explain how it feeds on 'insects'.
10. Explain the mode of nutrition in utricularia.

5. Organisms and environment

biosphere and energy flow - man and his environment - soil, rainfall and temperature with reference to natural resources; their uses - balance in nature is upset by over-population, abuse of natural resources - man in the biosphere - habitat and ecosystem - food and shelter - man's role in the deterioration of environment, cutting of trees, for example - forests and environment.

The living organism is affected by both the living and non-living environment. The environment in which we live changes continuously. But most living organisms are able to adapt themselves to the changing environment.

Soil, water and temperature are natural resources. Man has been exploiting the environment and the natural resources, and this will have long-term effects on the living world.

In the living world, food materials are supplied by the green plants. Animals which eat the plants are eaten by other animals. Thus energy flows from one organism to another.

One of the most impressive things about living organisms is their potentiality for excessive multiplication. When space and food do not increase to cope with the increased rate of reproduction, over - population leads to struggle for existence. In the struggle for existence, nature allows only the fittest to survive.

5.1 Biosphere and energy flow

Look around your house or school. All living and non-living things you can see form your environment. The total space occupied by living organisms is termed *biosphere*. There is animal and plant life on land as well as in water.

PRODUCERS

Green plants make their own food by a process called *photosynthesis*. Their leaves trap light energy and convert it into the chemical energy of food. Green plants are called *producers* because they make their own food using solar energy.

CONSUMERS

Animals have to obtain their food from external sources because they cannot make it for themselves. So all animals are called *consumers*. The animals which eat plants are *herbivores* or *primary consumers*. Grasshoppers, earth worms, caterpillars, cows, sheep, deer, rats and squirrels are examples of primary consumers.

Those which eat the herbivores are *carnivores* or *secondary consumers*. These include crows, dogs, cats, wolves and snakes.

These carnivores or secondary consumers are in turn eaten by animals like the tiger, hawk and vulture, which feed on herbivores also. These are *tertiary consumers*.

The chain of events in which the food energy is passed from the producers through a number of consumers is called a *food chain*.

When the producers and consumers die, their bodies are broken down into simpler products by certain organisms such as bacteria and fungi. These organisms are called the *decomposers*. The simpler substances are once again used by green plants for building up new materials.

Activity 1: *Draw an outline map of your village or city and identify the different types of habitats present there.*

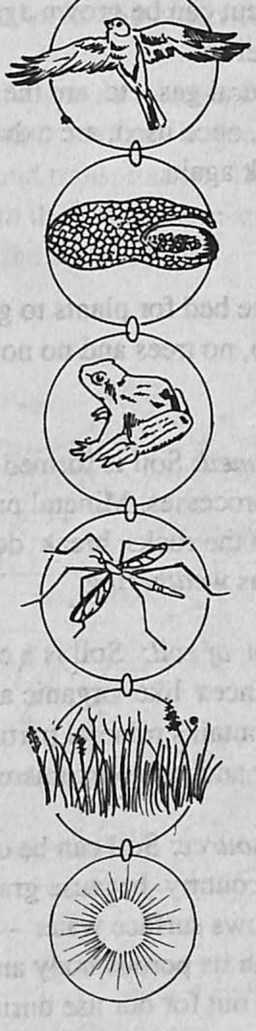


Fig. 5.1 A food chain.

5.2 Man and his environment

All living organisms depend on soil, air and water. So the environment in which we live is also the environment for other creatures.

Oil, natural gas, water, forests and the living organisms that live in them are useful to man in various ways. These are called natural resources, which are of two types: 1) renewable natural resources, and 2) non - renewable natural resources. Resources like soil, water, forests, etc. are the renewable natural resources, because once used, they can be restored or grown back within a reasonable period of time. Trees which are cut can be grown again; soil forms again and animals reproduce themselves.

Coal, oil, natural gas, etc. are the non - renewable natural resources. These resources, once used, are exhausted for ever. There is no way of getting them back again.

SOIL

Soil provides the bed for plants to grow. Without soil there would be no grass, no crop, no trees and no nourishment for man or other land animals.

How soil is formed: Soil is formed as a result of physical, chemical and biological processes. Mineral particles form the bulk of soil, and are formed when the rocks break down. This process of breaking down is known as *weathering*.

The composition of soil: Soil is a complex mixture of various chemical substances like organic and inorganic materials. A typical sample of soil contains mineral particles, humus, water, dissolved mineral salts, air and microorganisms.

Soil as a resource: Soil can be considered as the basis of prosperity of a country because grains, vegetables and fruits grow in the soil. Soil allows surface water — rains, streams and rivers — to percolate through its porous body and form the water table beneath. We pump this water out for our use during the dry season. Without the soil, all surface water would run off to the sea. In hilly regions, soil absorbs substantial amounts of the rainfall and reduces the threat of floods. Soil is often carried away by strong winds or washed away by rains and rivers. This is called *soil erosion*. Soil erosion can be prevented by planting trees in rows, as soil is firmly held by the roots of the plants.

RAINFALL

Water in very essential for all living organisms. Man needs water for drinking, cooking, irrigation, washing, cleaning and for generating energy. The major sources of water are rivers, lakes, wells, streams, etc.

underground rocky layer and forms deposits of underground water. The roots of plants take in the water retained by the top layer of the soil.

The water of the atmosphere reaches the earth surface in the form of rain and from the earth surface it gets back to the atmosphere through evaporation and transpiration. Thus, continuous circulation of water from the earth to the atmosphere and vice versa is maintained by nature. This is called the *water cycle*.

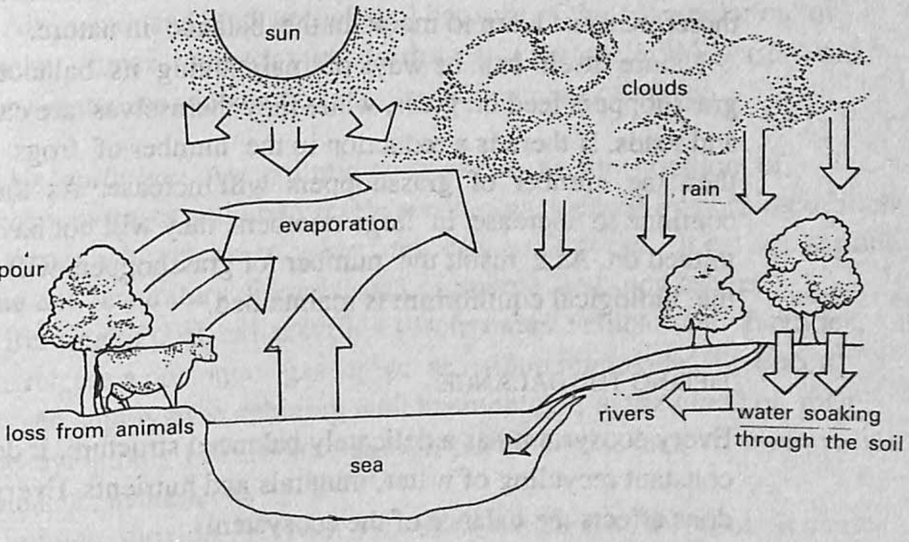


Fig. 5.2 Water is moving through the air and through living things.

TEMPERATURE

Temperature is an important factor as it influences plant growth and reproduction. It stimulates the growth of seedlings. The optimum temperature for seed germination ranges between 20°C and 27°C.

The absorption rate is retarded at low temperatures. Photosynthesis operates over a wide range of temperatures. The rate of respiration increases with the rise of temperature. Temperature has a definite influence on the rate of transpiration. Increase in transpiration is directly proportional to the difference in temperature between the leaf surface and the air surrounding it.

5.3 Balance in nature

The earth supports a large number of living organisms which compete with each other for food and shelter in order to live, reproduce and multiply. Lower organisms such as amoeba and bacteria multiply very fast and produce several hundreds of offspring within a short period. Higher organisms such as vertebrates produce fewer organisms at a lower rate. If all these organisms continued to exist and reproduce, there would not be enough space for them to live in. If such a situation occurs, the balance in nature is upset. Man ultimately suffers due to this imbalance, and therefore must learn to maintain the balance in nature.

Nature itself has its ways of maintaining its balance. For instance, grasshoppers feed on grass, while they themselves are eaten by frogs and toads. If there is a reduction in the number of frogs and toads, then the number of grasshoppers will increase. As the grasshoppers continue to increase in large numbers, they will not have enough grass to feed on. As a result the number of grasshoppers will decrease. Thus the biological equilibrium is maintained.

TIPPING THE BALANCE

Every ecosystem has a delicately balanced structure. It depends on a constant recycling of water, minerals and nutrients. Everything that man does affects the balance of the ecosystem.

OVERGRAZING

Overgrazing will lead to reduction in grass and the cattle begin to starve and die. The number of living cattle depend upon the quantity of grass available. If there is shortage of water, then too the grass will not grow. Due to the large number of cattle and shortage of water, it will also be difficult to grow crops and vegetables.

FARMING

Growing the same crop year after year can make the soil poor in quality. If the spongy humus is destroyed, the soil dries out, and this causes soil erosion. Cutting down mountain forests can reduce rainfall. Cutting down forests in valleys can cause floods.

INTRODUCING CHAOS

If man introduces new plants and animals into a habitat, it can upset the whole ecosystem. For example, when rabbits were introduced into Australia they bred very fast because they had no enemies or competition for food. They soon became a national problem.

POLLUTION

Pollution is an undesirable change in the physical, chemical or biological characteristics of air, water or land, harmful to human beings and other organisms.

Air, water and land are polluted because of the accumulation of smoke, fumes, industrial wastes, domestic sewage, solid wastes, etc. The substances causing pollution are known as pollutants.

Air pollution: Air pollution occurs due to the addition of poisonous gases and undesirable substances released by burning of fuels or through the release of gases from various factories. It causes serious lung and respiratory diseases such as asthma and lung cancer.

Burning of coal, exhaust fumes from motor vehicles and factories, etc. release a poisonous gas known as carbon monoxide. It reduces oxygen supply by combining with haemoglobin in the blood of man. The symptoms of carbon monoxide poisoning are lack of energy, headache, nausea, etc.

Sulphur dioxide is given out during the burning of coal. It causes irritation in the eyes, throat, nose and lungs. Sulphur dioxide damages the leaves and tissues of plants also.

Carbon dioxide is released into the air during the processes of respiration and combustion. Too high a concentration of carbon dioxide is harmful to life and will make the atmosphere retain a higher proportion of heat.

There are minute particles of all sorts of substances suspended in the air. They include smoke, dust, droplets, lead, etc. They are harmful to plants as well as to human beings.

Water pollution: Industrial wastes from factories are discharged into rivers. Insecticides, fungicides and fertilizers get washed into rivers, streams and lakes. Sewage is dumped in river water. These are the sources of water pollution. The polluted water becomes changed in its quality or composition so that it becomes less suitable for drinking, domestic and agricultural purposes, for breeding fishes and so on.

Land pollution: Indiscriminate use of fertilizers, pesticides, fungicides, etc. pollute the soil. These chemicals kill the useful bacteria in the soil, thus affecting the growth of some plants.

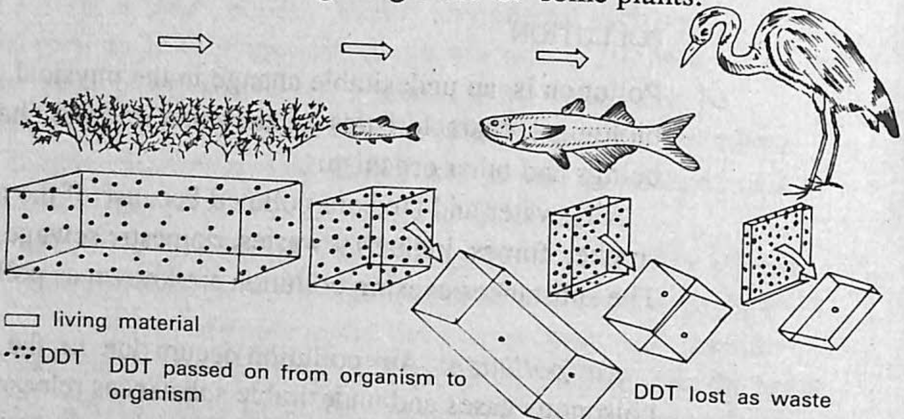


Fig. 5.3 How DDT builds up in food chains.

Activity 2: *Make a list of all the environmental changes which took place in your locality last year. List out the advantages and disadvantages of such changes.*

5.4 Man in the biosphere

Man is totally dependent on the living as well as the non-living environment for his survival. It is, therefore, the duty of man to maintain the balance in his environment. Pollution of the environment by man himself is one of the major dangers facing human and other forms of life today.

The animals and plants in the environment do not affect it in any way. It is man who, in order to exploit the environment, affects the resources. Man must learn to use these resources wisely for the sake of future generations.

5.5 Habitat and ecosystem

The plants and animals of an ecosystem are interdependent. In a pond, plants and green algae make use of sunlight and produce food and hence they are the *producers*. The insects and tadpoles feed on the producers and are the *primary consumers*. The small fish which feed on the water insects are the *secondary consumers*, and the larger fish that feed on the small fish are the *tertiary consumers*.

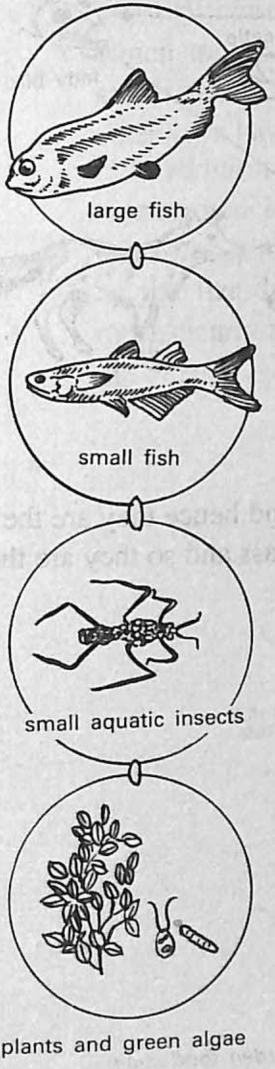


Fig. 5.4 Food chain in a pond

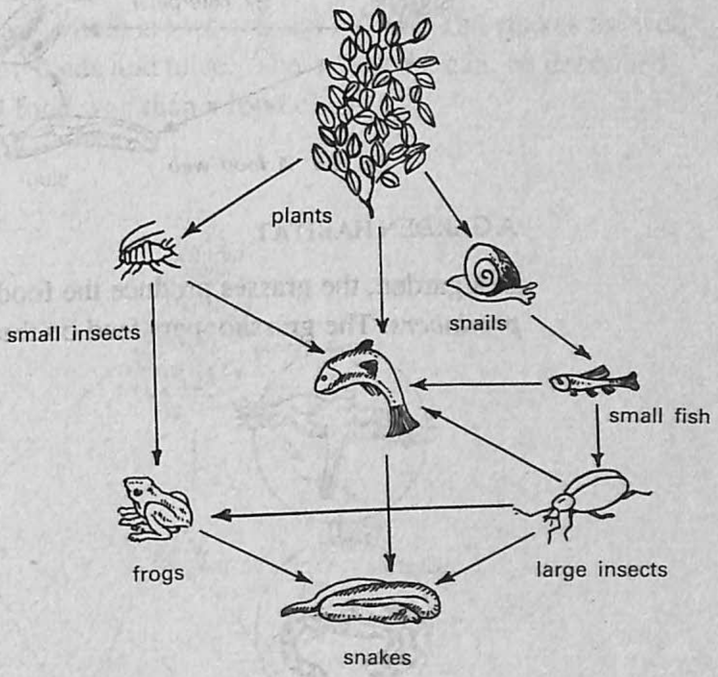


Fig. 5.5 Food web in a pond

In addition to the organisms mentioned, there may be frogs, snails, larger insects and snakes in the ponds, forming a complex food web shows the food web in a pond.

FOOD WEBS

In a habitat, one animal may be the food of several different kinds of animals, and may be part of several food chains. Many food chains are linked together in this way. If all the food chains were drawn on paper they would look like a spider's web. That is why these complicated food relationships are called *food webs*.

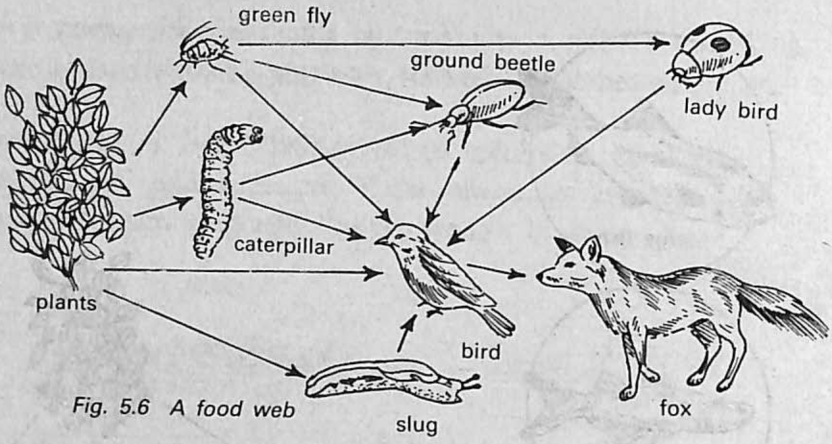


Fig. 5.6 A food web

A GARDEN HABITAT

In a garden, the grasses produce the food, and hence they are the *producers*. The grasshoppers feed on the grass and so they are the

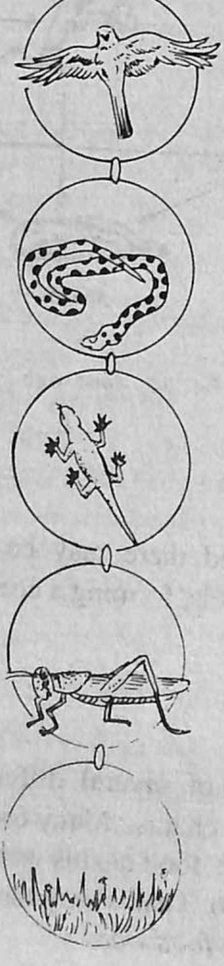


Fig. 5.7 A garden food chain

primary consumers. The grasshoppers may be eaten by the frogs which are the *secondary consumers*. These may in turn be eaten by a snake which becomes the *tertiary consumer*. The snake may be finally eaten by a hawk.

In addition to the animals already mentioned above, there may be worms which feed on the humus, mice which feed mostly on seeds and fruits, and toads which eat worms and insects. The snakes as well as the lizards eat toads and mice. The situation can be described more clearly by a food web than a food chain.

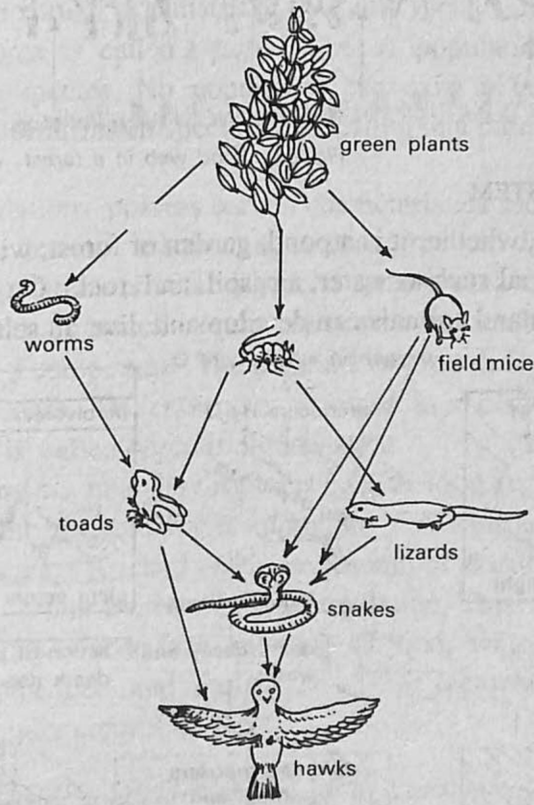


Fig. 5.8 Food web in a garden

A FOREST HABATAT

Here the plants are the *producers*. The buffalo, pig, rabbit and deer feed on the leaves of plants. They are the *primary consumers*. The leopard, wolf and the hyena are the *secondary consumers*.

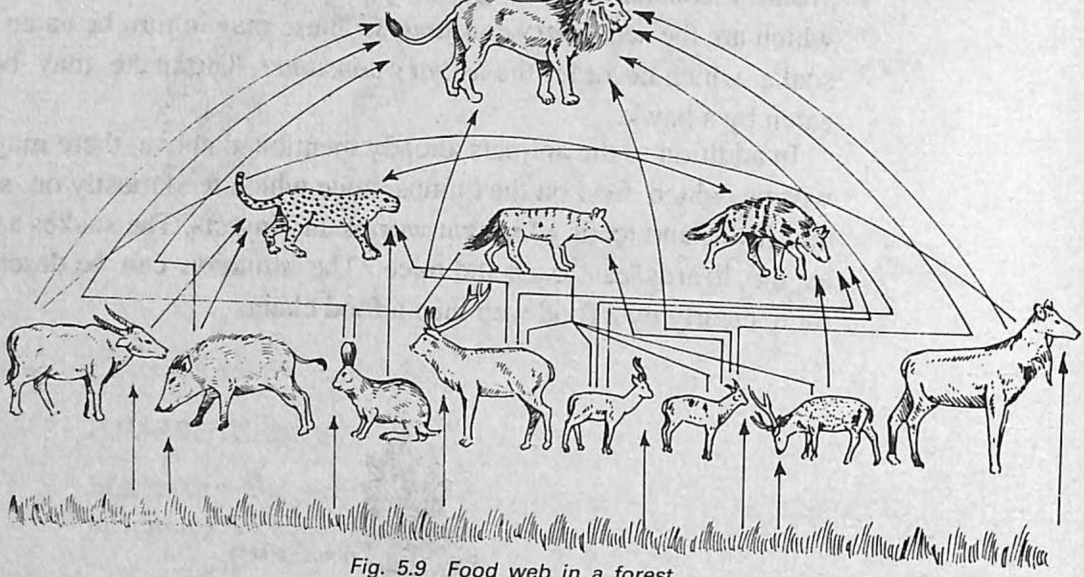


Fig. 5.9 Food web in a forest

THE ECOSYSTEM

Any habitat, whether it is a pond, garden or forest, will contain non - living material such as water, air, soil and rock. On these materials many plants and animals can develop and live in self-supporting

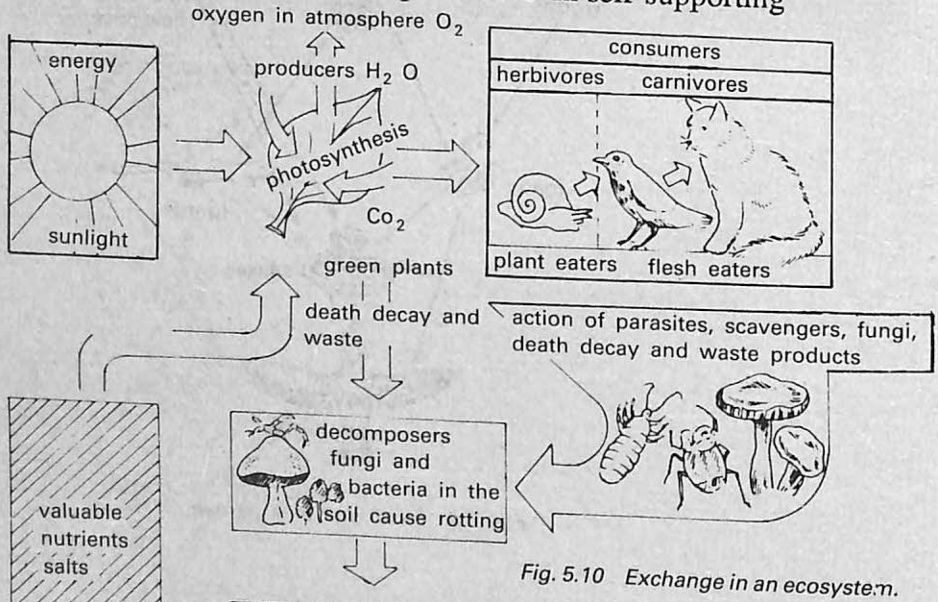

oxygen in atmosphere O_2
energy
sunlight
producers H_2O
photosynthesis
Co_2
green plants
consumers
herbivores
carnivores
plant eaters
flesh eaters
death decay and waste
action of parasites, scavengers, fungi, death decay and waste products
decomposers fungi and bacteria in the soil cause rotting
valuable nutrients salts
transformers other bacteria in the soil change rotten material releasing valuable nutrients

Fig. 5.10 Exchange in an ecosystem.

communities. The living and non- living parts of a habitat together form an *ecosystem.*

Ecosystems are powered by heat and light from the sun. Within the system there is a continuous exchange of materials between the living organisms and the environment.

Activity 3: *Select a habitat like a pond or garden. Identify the different types of organisms in that particular habitat and try to find out where they live and what they eat.*

5.6 Sharing of food and shelter by members of a population

A group of similar organisms of the same species living in a particular area is called a *population.* A population always consists of a single species. No population can exist in isolation. Several populations of different species co-existing in a particular area form a *community.*

All populations possess certain characteristics such as birth rate, death rate, density, relative age structure and distribution pattern. Once a population is established, it undergoes a rather specific growth pattern, provided conditions remain favourable and the habitat is free from a competitor. The population growth is slow at first and later it increases. The enormous increase in the growth of a population is called *population explosion.*

All organisms in an environment require food and shelter. The capacity of the environment to supply the needs of the species is limited. A point is always reached when the amount of food is insufficient to support any furthur increase in the population. This implies that the population may have to face shortage of food, which results in keen competition for food and shelter. This is the factor which keeps the population under control.

Activity 4: *Divide your class into groups to visit some places in your village or city. Educate the people about the harmful effects of overpopulation, with posters, banners, etc.*

5.7 Relationship in a population

Within a habitat, certain relationships are established among the populations of different organisms. The most common is the food relationship. It controls the number of members in the given population.

Predation is the direct food relationship between two organisms. In this case, one animal eats the other. In a jungle, the lion eats the deer. Here the lion, i.e., the eater, is called the *predator* and the deer that is eaten is called the *prey*. If lions are hunted on a large scale, their population would reduce causing the population of deer to increase. This would result in the destruction of the nearby fields by them for want of other food. Man and other animals which depend on crops for their food would be deprived of it. Thus, the predators keep a check on the prey population within a community.

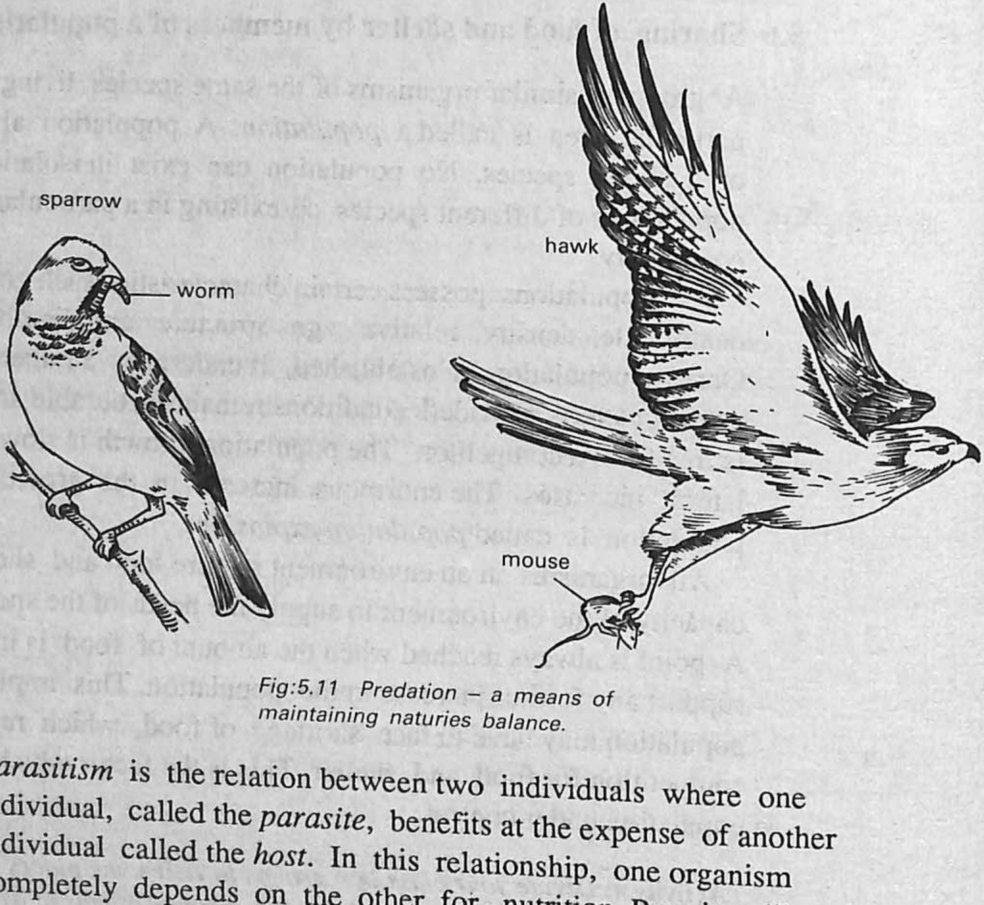


Fig:5.11 Predation – a means of maintaining naturies balance.

Parasitism is the relation between two individuals where one individual, called the *parasite*, benefits at the expense of another individual called the *host*. In this relationship, one organism completely depends on the other for nutrition. Parasites like roundworm and tapeworm living in the human body are examples.

Mutualism is another type of relationship between two organisms where both the organisms mutually benefit.

Scavenging is the food relationship between a dead animal and the animal which consumes it. The latter is called a *scavenger*.

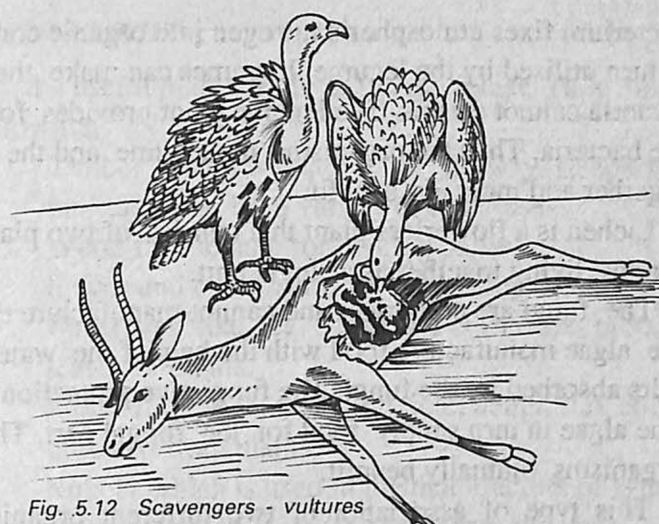


Fig. 5.12 Scavengers - vultures eating a dead animal

Scavengers keep the environment clean by eating up the carcasses, e.g., vultures and jackals.

Decomposers are mostly microorganisms such as bacteria which act on the dead bodies of the producers and consumers and are responsible for breaking up complex materials into simpler substances. These substances are in turn consumed by the producers, i.e., the plants, to complete the cycle.

5.8 Food and shelter

The roots of most legumes prduce gall-like *nodules*. A bacterium known as *Rhizobium* lives in the root nodules of plants. This

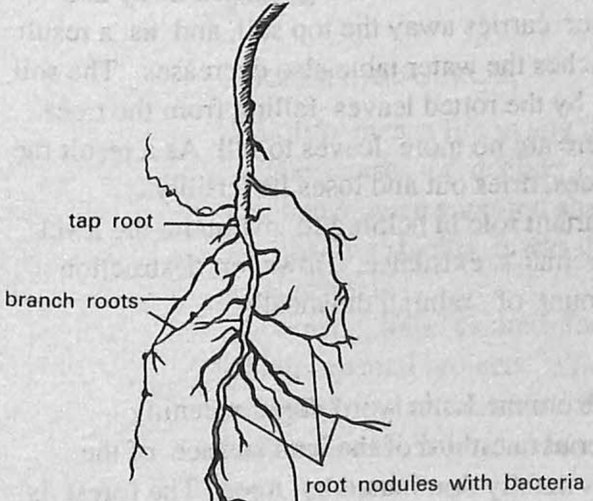


Fig. 5.13 Bacteria in the roots of a leguminous plant

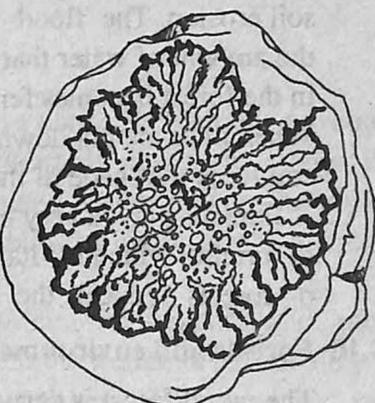


Fig. 5.14 Lichen is really two plants, a fungus and an alga. The alga gives the lichen its green colour and makes food by photosynthesis. The fungus helps to get mineral salts from the rock.

bacterium fixes atmospheric nitrogen into organic compounds which are in turn utilised by the legume. Legumes can make their own food but bacteria cannot do this. The legume plant provides food and shelter for the bacteria. Thus the organisms, the legume and the bacterium, live together and mutually benefit.

Lichen is a flowerless plant that consists of two plants, an alga and a fungus, living together as a single unit.

The fungi are colourless and cannot manufacture their own food. But the algae manufacture food with the help of the water and mineral salts absorbed by the fungi. The fungi give protection to the algal part. The algae in turn supply food for the fungal part. Thus both the organisms mutually benefit.

This type of association of two different organisms living together as a single unit, obtaining mutual benefit, is called *symbiosis*. The two organisms taking part in symbiosis are called *symbionts*.

5.9 Man's role in the deterioration of the environment

There are a number of natural events like floods, earthquakes, droughts, cyclones, etc. which take a heavy toll of human life and properties. But worse problems are created by man. 1) Agricultural land has been used for building. 2) As the population increases, there is a corresponding increase in pollution as well. Man pollutes air, water and soil, affecting the existence of all living beings in them. 3) When man cuts and burns the trees in the forest, he destroys the precious plant cover, which leads to the soil being washed away and soil erosion. The flood water carries away the top soil, and as a result the amount of water that reaches the water table also decreases. The soil in the forest becomes fertile by the rotted leaves falling from the trees. When trees are cut down there are no more leaves to fall. As a result the soil loses the shade of the trees, dries out and loses its fertility.

Forests play a very important role in helping to maintain the level of rainfall which is vital for man's existence. However, destruction of forests reduces the amount of rainfall drastically.

5.10 Forests and environment

The word forest is derived from the Latin word *foris* meaning 'outside'. Forests occupy about one-third of the land surface of the world. They are ecosystems mainly dominated by trees. The forest is considered as a very important source of wealth for man.

USES OF FOREST

All the useful plants are found in the forest. They provide us with the following:

1. Timber which is required for railway sleepers, furniture, buildings and for a variety of other uses.
2. Wood for fuel and for making paper.
3. Spices and condiments for flavouring food.
4. Beverages like tea, cocoa and coffee are prepared from the leaves of plants.
5. Fibres for garments, cotton, jute, hemp, flax and coir are also obtained from plants.
6. Rubber which is used in the manufacture of tyres and tubes.
7. Tannins and dyes are obtained from the trees.
8. Forests bring rain, thereby providing water for plants and animals.
9. Forests help in the prevention of floods by increasing the speed of run-off water without logging.
10. Many animals and birds live in the forest. They are considered as the wealth of the forest.

TYPES OF FOREST

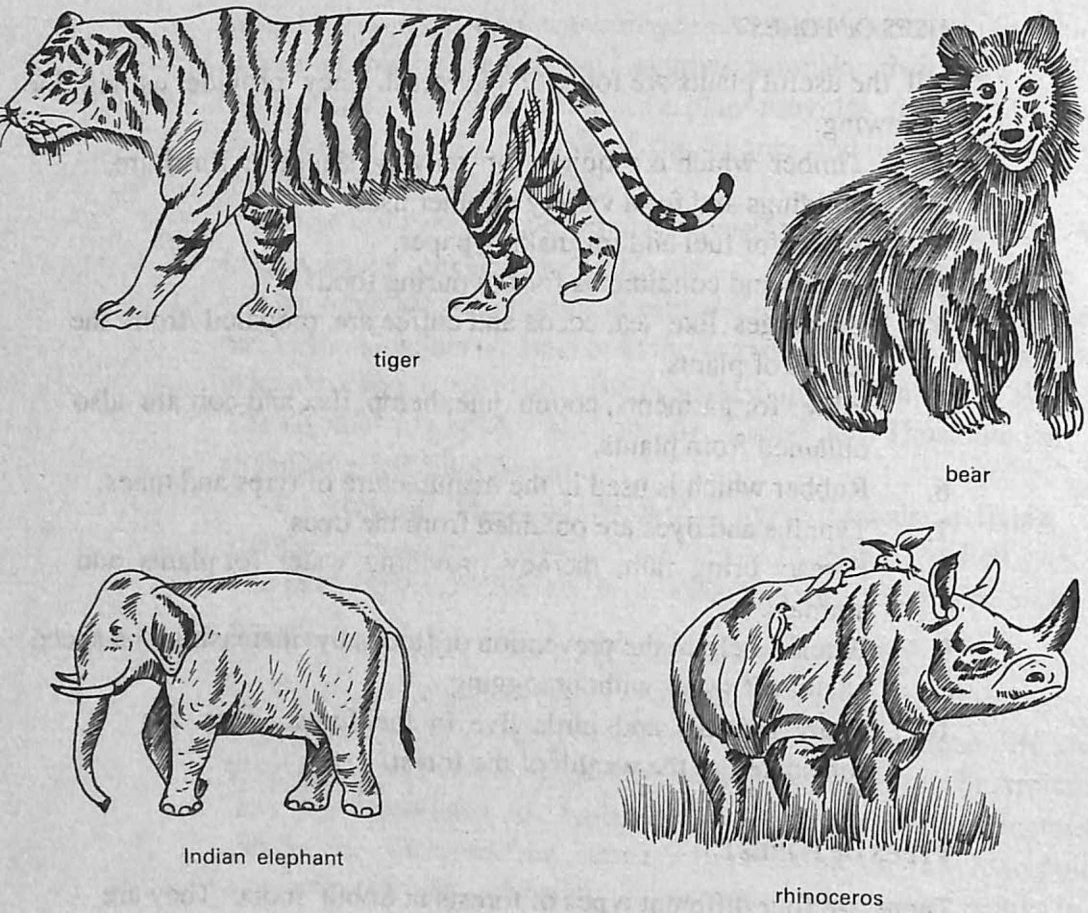
There are four different types of forests in South India. They are autumn forest, acacia forest, south temperate wet forest and shrub jungle.

WILDLIFE RESOURCES

Wildlife means life in any form existing in natural surroundings.

The causes of decline of wildlife in India are many. Wild elephants were captured and trained for use in war. Rhinos were killed for making shields. It was the hobby of many rulers in the past to hunt wild animals.

Forests were cleared for agriculture, industry and other developmental projects. Wild animals were indiscriminately killed resulting in the decline of their numbers. Many species are, unfortunately, facing extinction now.



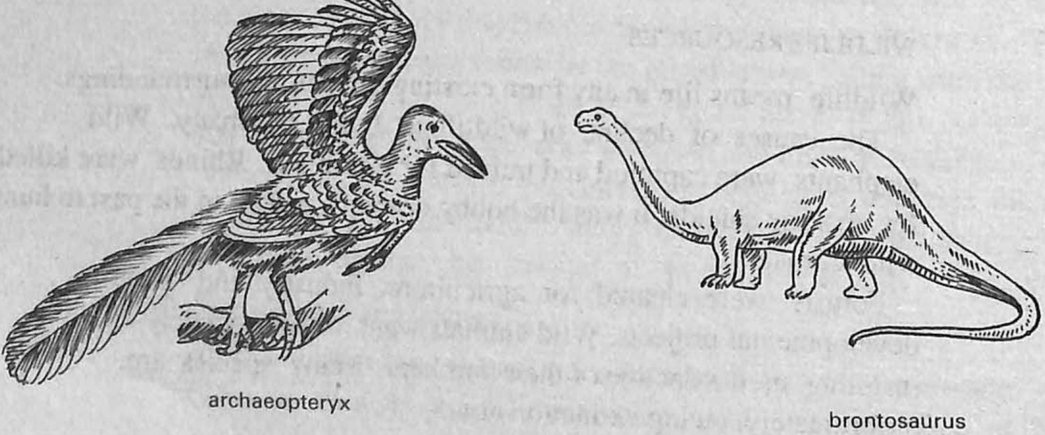
tiger

bear

Indian elephant

rhinoceros

Fig: 5.15 Some forest animals.



archaeopteryx

brontosaurus

Fig. 5.16 Some extinct animals

CONSERVATION OF WILDLIFE

The protection of wildlife from thoughtless destruction is called conservation.

Well planned projects for conservation of forests and wildlife are being carried out with aid from the World Wild life Fund which was set up in 1962. The International Union for the Conservation of Natural Resources was formed with this specific purpose. The year 1972 was declared as the International Year of Nature Conservation. The Indian Board of Wildlife was established in November 1952. The aim of these organizations is that each one should implement the laws and create public awareness.

There are many wildlife sanctuaries and national parks in India. The Government of India celebrates the 'Wildlife Week' during the first week of October every year in order to educate the public on the importance of wildlife.

Some basic concepts

1. The living organism is affected by both the living and non-living environment.
2. The total space occupied by all living organisms is called biosphere.
3. The chain of events in which food energy is passed from a producer through a number of consumers is called a food chain.
4. Man has to use the renewable and non-renewable resources in nature wisely.
5. The important factors in the environment are soil, rainfall and temperature.
6. The delicate balance in nature has to be preserved carefully, and protected from factors like overgrazing, pollution, etc.
7. There are different habitats for living organisms. The living and non-living parts of a habitat together form the ecosystem.
8. Various relationships exist within an ecosystem.
9. Man, who has been responsible for the deterioration in the environment, has to learn to conserve the forest and wildlife wealth that is still available to him.

Some suggested activities/projects

1. Collect and preserve some of the plants which are used as spices and condiments.
2. Make a chart and mention some of the national parks and sanctuaries which are engaged in the conservation of wildlife.

engaged in the conservation of wildlife.

Make some placards and keep them in some places in your locality in order to create public awareness about the effects of pollution.

4. In a chart, prepare a diagrammatic representation of energy flow in the biosphere.

REVISION TIME

I. Choose the correct answer:

1. The total space occupied by the living organism is termed
   - a. habitat.
   - b. biosphere.
   - c. niche.
   - d. environment.
2. All animals are
   - a. consumers.
   - b. producers.
   - c. symbionts.
3. The carnivores are
   - a. tertiary consumers.
   - b. primary consumers.
   - c. secondary consumers.
4. Bacteria and fungi which break down the dead bodies of animals into simple products are
   - a. decomposers.
   - b. producers.
   - c. predators.
5. Renewable natural resources are
   - a. coal, oil and natural gas.
   - b. soil, water and forest.
   - c. wood, leather and fabrics.

6. The process of breaking down of rocks is called

a. manuring.

b. weathering.

c. dehydrating.

7. The process of carrying away of soil by strong winds, rains and river is called

a. erosion.

b. conservation.

c. percolation.

8. The poisonous gas given out by burning of coal, motor vehicles and factories is

a. carbon dioxide.

b. sulpur dioxide.

c. carbon monoxide

9. A population always consists of ____________

a. the same species.

b. two different species.

c. many species.

10. The mutually beneficial relationship between two completely different organisms is called

a. predation.

b. symbiosis.

c. commensalism.

II. Match the following:

1. dogs, wolves, snakes	prey
2. bacteria, fungi	photosynthesis
3. soil, water, forests	beverages
4. insecticide	carnivores
5. smoke, fumes, sewage	actual resources
6. vulture, jackal	decomposers
7. tea, coffee, cocoa	D.D.T.
8. grasshoppers, caterpillars, cows	scavengers

9.	predator	herbivores
10.	green plants	pollutants

III. *Supply the scientific terms for the following:*

1. The total space occupied by living organisms.
2. The chain of events in which the food energy is passed from the producer through a number of consumers.
3. The carrying away of soil by strong wind, rain and rivers.
4. The complicated food relationship with several food chains.
5. A group of similar organisms of the same species living in a particular area.

IV. *Fill in the blanks:*

1. The substances causing pollution are known as __________________.
2. Green plants are called __________________ because they can make their own food.
3. The herbivores are eaten by __________________.
4. The most important source of water is __________________.
5. The optimum temperature for seed germination ranges between __________________ and __________________.
6. Complicated food relationships are called __________________.
7. __________________ is the bacterium living in the root nodules of legumes.
8. Lichen is the symbiotic association of __________________ and __________________.
9. __________________ were killed for making shields.
10. Tapeworms and roundworms are __________________ which live in the human body.

V. *Mark true or false.*

1. The carnivores are eaten by herbivores.
2. Man is dependent on plants and animals.

3. Coal, oil and natural gas are renewable natural resources.
4. Soil is formed as a result of physical, chemical and biolgical processes.
5. The rate of respiration decreases with the rise of temperature in plants.
6. Living organisms compete with each other for food and shelter.
7. Growing the same crop year after year can make the soil rich in minerals.
8. Insecticides are used to control insect pests.
9. In a habitat, one animal is the food for only one kind of animal.
10. The clearing of forests will increase the amount of rainfall.
11. Spices and condiments are used for flavouring food.

VI. *Answer the following questions:*

1. What are renewable natural resources?
2. Explain secondary and tertiary consumers.
3. Explain the food chain in a pond with a suitable diagram.
4. What are decomposers and scavengers? Give two examples for each.
5. How is soil formed?
6. Explain balance in nature with suitable examples.
7. Define pollution and pollutants.
8. Give a brief account of water pollution.
9. How is forest useful to man?
10. Explain symbiosis with suitable examples.

TEST PAPER I

I. Choose the correct answer from the list given after each question:

1. Carrot is an example for
   a. annuals.
   b. biennials.
   c. perennials.
2. The cell wall in plants is made up of a special substance called
   a. mucopeptide.
   b. phospholipids.
   c. cellulose.
3. Which of these plant groups has no chlorophyll?
   a. fungi.
   b. algae.
   c. bryophytes.
4. The upward movement of water is called
   a. translocation.
   b. absorption.
   c. ascent of sap.
5. Nastic movement is seen in
   a. spirogyra.
   b. diatoms.
   c. touch-me-not.
6. Which of the following fruits is a parthenocarpic fruit?
   a. grape.
   b. apple.
   c. mango.
7. Flowering hormone is the name given to the hormone
   a. gibberellin.
   b. florigen.
   c. ethylene.

8. The functional and structural units of living organisms are
   a. tissues.
   b. organs.
   c. cells.
9. The apparatus used to measure the rate of growth in plants is the
   a. auxanometer.
   b. klinostat.
   c. heliotropic chamber.
10. During the stage of elongation
   a. the cells divide and multiply.
   b. the cells differentiate.
   c. the cells enlarge in size and elongate.

II. Distinguish between the following, describing any two differences:

1. Woody perennials and herbaceous perennials.
2. Holyphytic nutrition and holozoic nutrition.
3. Xylem and phloem.
4. Cell wall and cell membrane.
5. Apical meristem and lateral meristem.

III. Fill in the blanks with suitable words:

1. Movement toward the external stimulus of ________________ is termed hydrotropism.
2. ________________ inhibits growth.
3. The response of a plant to a stimulus is called ________________ .
4. ________________ are the minute openings present in between the epidermal cells.
5. Xylem is otherwise known as ________________ .
6. A compact layer of parenchymatous cells which surrounds the vascular bundles is know as ________________ .
7. ________________ is an example of green algae.
8. Amoeba and yeast are said to be ________________ .
9. Growth in animals is________________ .
10. The growth period as a whole is known as the ________________ ________________ of growth.

IV. Write short notes on any five of the following;

1. Biennials and perennials
2. Nastic movements
3. Mesophyll
4. Movement in chlamydomonas
5. Hydrotropism
6. Auxins
7. Grand period of growth
8. Seasonal variations in growth

V. Draw a labelled sketch of any one of the following:

1. A typical animal cell.
2. T.S. of a dicot leaf.

VI . Answer any three questions choosing not more than two from each section.

Section A.

1. List the differences between plants and animals.
2. Describe an experiment to prove that water is conducted upwards through the xylem.
3. Describe an experiment to show the regions of growth.

Section B.

1. How can you classify plants on the basis of their life span?
2. Describe an experiment to prove that the main axis of the stem is negatively geotropic.
3. How can you measure the rate of growth with the help of the lever auxanometer?

TEST PAPER II

I. Choose the correct answer:

1. Paddy is an example of

   a. annuals.

   b. biennials.

   c. perennials.

2. When the xylem and phloem form separate bundles and lie on different radii alternating with each other, the arrangement is said to be

   a. collateral.

   b. radial.

   c. bifacial.

3. During winter season the growth is

   a. high.

   b. not affected.

   c. low.

4. Photolysis of water is

   a. spliting of carbon dioxide.

   b. spliting of water molecules into hydrogen and oxygen.

   c. union of hydrogen and hydroxylions.

5. The chemicals produced by some bacteria causing food poisoning are

   a. growth promotors.

   b. insecticides.

   c. toxins.

6. Pulses stored for long periods may be infected by

   a. rodents.

   b. worms.

   c. microorganisms.

7. Fish and meat are transported to far off places

   a. in special hot containers.

b. in cold containers.

c. in refrigerators.

8. The total space occupied by living organisms in termed

a. habitat.

b. environment.

c. biosphere.

9. The process of breaking down of rocks is called

a. weathering.

b. manuring.

c. dehydrating.

10. The mutually beneficial relationship between two completely different organisms is called

a. predator.

b. symbiosis.

c. commensalism.

II. *Distinguish between the following:*

1. Autotrophs and heterotrophs.
2. Growth in plants and growth in animals.
3. Movement of locomotion and movement of curvature.
4. Parasites and saprophytes.
5. Scavengers and decomposers.

III. *Fill in the blanks with suitable words or phrases, as the case may be, in the following:*

1. Animals can move from place to place in search of ________________ , ________________ and to ________________ .
2. ________________ is the substance which is liberated by the hormone ethylene.
3. The movement of curvature in response to light is called ________________ .
4. ________________ is defined as a permanent increase in the bulk of an organism.
5. The________________ meristems are present at the nodes.
6. Cuscuta is a________________ parasite.
7. ________________ is one of the most serious types of food poisoning.

8. Green plants are _______________ in their mode of nutrition.

9. The substances causing pollution are known as _______________.

10. _______________ were killed for making shields.

IV. Write short notes on any five of the following. The answers should not exceed fifteen lines:

1. Uses of plant hormones.
2. Phototropism.
3. Auxanometer.
4. Role of fungi in the spoilage of food.
5. Hibernation.
6. Nepenthes.
7. Balance of nature.
8. Uses of forests.

V Draw a labelled sketch of any one of the following:

1. Food chain in a garden.
2. A bacterial cell.
3. A typical plant cell.

VI. Answer any three questions selecting not more than two from each section given below. Answers for each should not exceed twentyfive lines:-

Section A.

1. How is the food chain formed in a forest habitat?
2. Explain the different methods of storing and preserving food materials.
3. Explain the stages of growth in plants.

Section B.

1. Write briefly about conservation of wildlife.
2. Describe an experiment to show that oxygen is evolved during photosynthesis.
3. What is 'adulterated food'?

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